Air Symposium 2015

Nation Building Through Maritime Air Security

Sri Lanka Air Force
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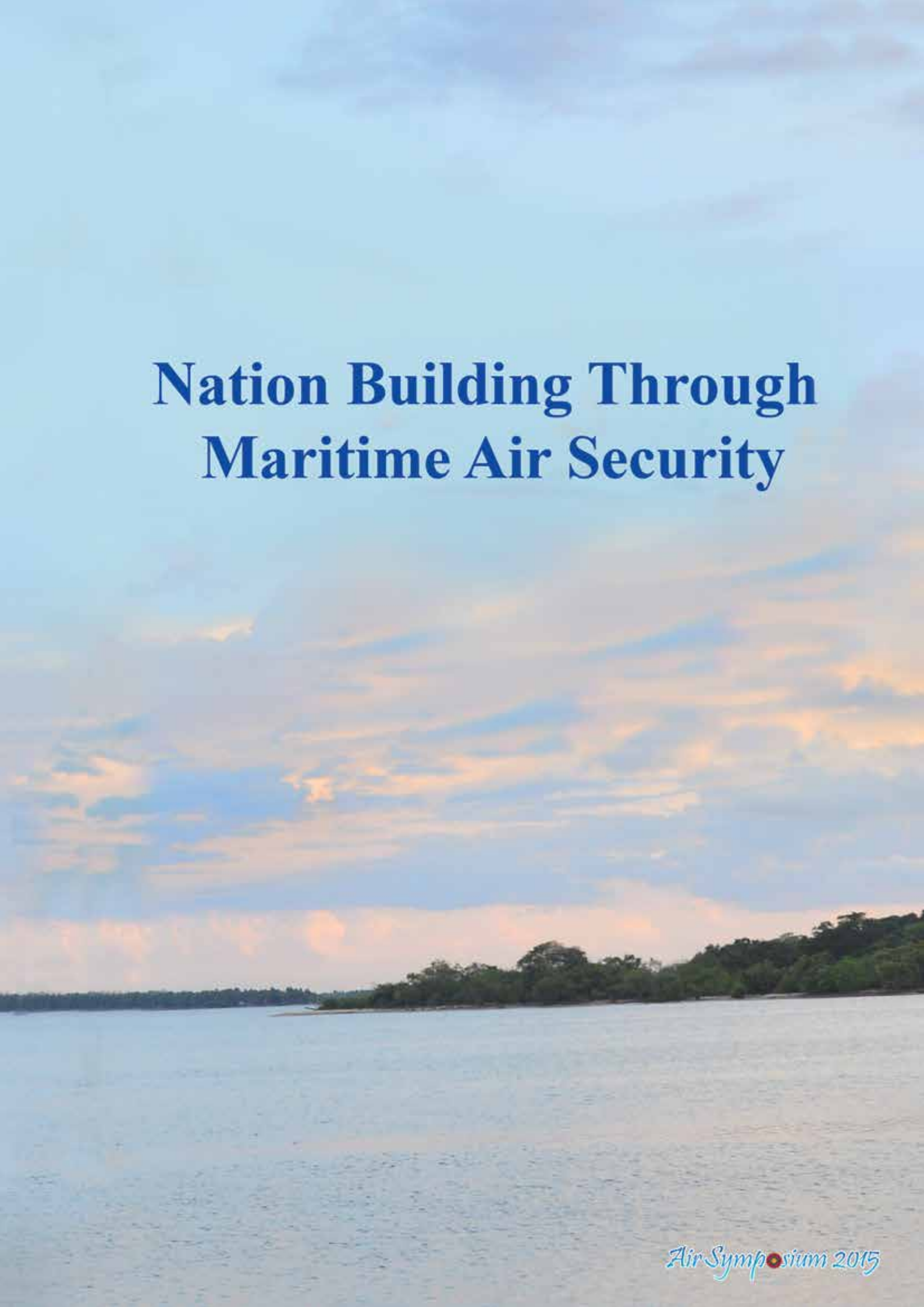

Air Symposium 2015

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Preface

Sri Lanka is an island nation with a strong maritime heritage and maritime interests throughout the history. Almost every aspect of our national life depends on our connections to the wider world, and most of these connections are provided by the sea. We depend on the sea for our prosperity and security and are reliant on a stable transportation for the raw materials, energy and manufactured goods critical to sustaining our way of life. Recent trends such as globalization, resource competition, population growth and climate change have changed the maritime domain to one that is simultaneously more connected – providing substantial growth opportunities for nation building of Sri Lanka; and more contested – in which developments in distant maritime regions can have an immediate and direct impact on our prosperity and security. As a nation, we have always looked into the wider world to shape and influence international events. This symposium critically explains how we organize and use our current national capabilities to identify, assess and address maritime security issues at home and overseas, and how we intend to improve our ability to do so in future through the most efficient use of available resources and resources we required to anticipate to utilized on maritime security. We will achieve the objectives set out here through a thorough understanding of the risks we face, coupled with an ambitious but pragmatic approach to the opportunities we could exploit – so as well as having the capabilities to respond to security incidents, we also undertake overseas capacity building, deterrence and diplomacy to disrupt potential future threats before they appear.

The Symposium will be an eye opening to study for comprehensive cross government approach to maritime surveillance, information gathering, and decision making, enhanced by regional and multinational cooperation, and supported by ongoing scrutiny to ensure we continue to improve. We will seek to take advantage of this opportunity by continuing to promote Sri Lanka as the global centre for maritime business, promoting a stable maritime domain and the freedom of the seas, and maintaining the Sri Lanka's position as a driver of international cooperation and consensus.

MESSAGE FROM THE SECRETARY TO THE MINISTRY OF DEFENCE

It is with great pleasure that I issue this message for the Air Symposium 2015 of Sri Lanka Air Force.

The great prominence that the Indian Ocean Region has taken in recent years in contemporary international affairs is evidence of the shift in the global balance of power. The rapid emergence of our Neighboring, India and China as Power houses in today's global stage is testimony to the emerging dynamics as regional giants which also means that Sri Lanka, a small island nation, is now potentially right in the Centre of this emerging world.

I am happy therefore, that the Sri Lanka Air Force has taken up the subject of Nation Building through Maritime Air Security as the theme for their Symposium this year is a very appropriate and timely topic for contemplation and consideration in today's geopolitical and security context.

Having put behind us, the destructive effects of a three decade long separatist terrorist conflict, we are now striving to recover lost progress, in the hope that we will be able to regain our rightful place in the international arena. Being an island nation, the ocean and its environs are our lifeline. It is both a medium of communication with the rest of the world and a treasure trove of natural resources that will help us in our journey to greater development. However, the oceans and their environs are not without their hazards. Today, sea-based terrorism, hijacking, piracy, and human trafficking as well as other threats have also made the seas potentially unsafe. Maritime security has become not just a formality but a real, even dire, necessity.

It is my firm belief that forums such as this will be the key medium through which we can gain better understanding on how to gain greater control cover the oceans around us, which would enable us to make maximum use of its potential for national growth and prosperity. I commend Commander of the Air Force for this vision and foresight in organizing an event of this nature and wish him, his men and all participants a great and fruitful interaction.

Eng. KARUNASENA HETTIARACHCHI
SECRETARY TO THE MINISTRY OF DEFENCE

MESSAGE FROM THE COMMANDER OF THE AIR FORCE

It is with great pleasure that I send my sentiments on the occasion of the inaugural *"Air Symposium - 2015"*.Sri Lanka as a nation underwent immense hardship during the three decade long conflict retarding the nation's development and growth. During this turbulent period the total focus of the Sri Lanka Air Force was to concentrate on its core competency to defeat the terrorist effort. In this process Sri Lanka Air Force gained immense experience in mastering the intricacies of waging complicated, non-conventional isometric aerial warfare. The knowledge and experience gained is extensive, but its growth as an Air Force institution was limited to the practicalities of war fighting, whereas in comparison regional Air Forces have taken great strides.

Thus, the inaugural Air Symposium has been aptly themed as 'Nation Building Through Maritime Air Security', with the aim of looking towards a future, in which the Sri Lanka Air Force evolves, to influence activity beyond its shores and contributes to the transition of Sri Lanka from a post conflict country, to a developed Nation. The Indian Ocean which covers almost 20% of the world's surface has dominated the economic and political affairs of the region and the world since the beginning of history; and Sri Lanka which geographically straddles the strategic Indian Ocean sea route is of immense geopolitical value, thus being vulnerable to influence.

In the economic context we as an Island are yet to fully exploit the abundant and diverse resources in our legitimate maritime zone. In the context securing these resources for viable use in the long term and also conservation, we need to possess the capacity to respond to the needs of their safety and security, the failure of which will result in their inaccessibility to our future generations.

The National Security interests of the Exclusive Economic Zone (EEZ) are the core responsibility of the Sri Lanka Navy, whilst policing it is the role of the still very young Sri Lanka Coast Guard. Though rarely emphasized, the Sri Lanka Air Force too has a substantial responsibility in relation to the National Security, aspects, and conservation of the Exclusive Economic Zone. The greater active involvement of the Sri Lanka Air Force, utilizing its core competencies would provide to augment the role already played by the Sri Lanka Navy and the Sri Lanka Coast Guard. To meet this need we need to identify specifics, build capacity, share knowledge and participate in a wider spectrum of activity than done at present. Thus, this Air Symposium is a stepping stone towards redefining, with greater emphasis the importance, value, and necessity of joint cooperation both at safeguarding and conserving maritime resources as well as policing the Exclusive Economic Zone.

I take this opportunity to pay tribute to all those who courageously took to battle in our nation and also remember with reverence those who laid down their precious lives. The hard learnt lessons through these sacrifices have been well-researched, analyzed and will be presented during Air Symposium 2015.

The dedication and academic contribution by the Officers submitting their research papers are highly commendable and I sincerely wish that they would continue their association with academic research on many other topics.

An event of this nature would not have been possible without an efficient team of organizers. I take this opportunity to convey my sincere appreciation to the Commandant of the Sri Lanka Air Force Academy China Bay and the members of the organizing committee for a tremendous job.

GP BULATHSINGHALA
RWP, RSP, VSV, USP, M Phil (Def & Strat Stu), MSc (Def Stu) in Mgt, FIM(SL), ndc, psc
Air Marshal
COMMANDER OF THE AIR FORCE

Executive Summary

Introduction

New ideas, indeed, never exist in isolation. Considering the Maritime Air Security related problems, geopolitics and joint operations have become a top priority in any defence milieu. We need the best officers and researchers to understand the contemporary changes that are taking place in the Sri Lanka Air Security context today, tomorrow and in the future. And also to explore appropriate solutions to Maritime Air Security related issues is vital and tremendously rewarding and productive. This endeavour aims to bring distinguished military figures, researchers and subject matter experts together and exchange their ideas and experience about aspects of the Maritime Air Security management and planning. It is very important and essential to blend the wisdom of SLAF officers especially in the field of defence who are capable and enriched in knowledge and skills in addressing critical issues of the Maritime Air Security in the aspects of nation building. Therefore, having an event like "Air Symposium 2015" will provide a unique foundation for SLAF officers to express their ideas and findings and share their knowledge in research and development to construct a field experts, professionals, researchers and policy makers while exposing to a broader area of knowledge. The main purpose of having this "Air Symposium" is to investigate feasible researches and transform them in to practical actions in nation development processes while opening a new vision to the Sri Lanka Defence. The "Air Symposium" as a platform to share standard research findings that will cater the demands of nation building activities to protect the resources and population of Sri Lanka and the Overseas Territories from illegal and dangerous activities, including serious organized crimes and terrorism.

The Air Symposium 2015 is four premises brought together: "Maritime Joint Operations", "Maritime Surveillance and Strike", "Maritime Search and Rescue" and "Maritime Air Cognition". The treatises are presented and unveiled under the topics mentioned.

Maritime Joint Operations

- "Implementation of Joint Maritime Operations" by SqnLdr KSUC Ranasinghe
- "Utilization of SLAF Helicopters in Joint Operations to Combat Illegal Sea Activities and Protection of Maritime Resources" by Wg Cdr SDGM Silva and Sqn Ldr RMAU Ratnayake

Maritime Surveillance and Strike

- "Transformation of Role in UAV Squadron to Meet the Maritime Security Challenges" by Sqn Ldr LHLK Liyanahetti.
- "Importance of formulating a Fighter Squadron with Maritime strike capability for Sri Lanka Air Force" by Sqn Ldr VS Jayakody and Flt HMTK Herath

Maritime Search and Rescue

- "Impact on Nation Building Through Maritime Security Integrated with Effective SAR Operations of SLAF: Post War Context of Sri Lanka" by Sqn Ldr LADP Sampath
- "The role of SLAF Elite Forces in Maritime Security: Air and maritime Perspective" by Wg Cdr SPVK Senadeera

Maritime Air Cognition

- "Spatial Disorientation as an Aero Medical Concern in Rotor Wing Maritime Operations of Sri Lanka Air Force" by Flt Lt SCB Madurawala
- "The Nexus Between Artificial Intelligence and Military Cognition: A Dire Requirement of Ensuring SLAF to Face the Future" by Sqn Ldr KGLK Kapugama.

Objectives

The main purpose of having an Air Symposium is to explore vital applied Maritime Air Security system on Sri Lanka defence context which can be in cooperated in national development process. Second, is to give a forum for SLAF officers to impart their lore and knowledge and let their visions to expose with subject matter experts and in addressing stressing issues of the present Maritime Air Security in Sri Lanka. Therefore having an event like this will provide a unique foundation for SLAF Officers to express their ideas and findings and share their knowledge in research and development to construct a better Sri Lanka.

It is in this juncture that Sri Lanka Air Force decided to hold "Air Symposium 2015" to discuss this pivotal problem at length with experts, professionals and officers arrive at symposium which will improve protecting the country in a better way and ultimately benefit the whole nation.

In such circumstances this symposium between experts, researchers and officers of armed forces in Sri Lanka will be a memorable experience guaranteed.

Speakers

Eng. Karunasena Hettiarachchi
Secretary to the Ministry of Defence

AM GP Bulathsinghala RWP, RSP, VSV, USP, M Phil (Def & Strat Stu), MSc (Def Stu) in Mgt, FIM (SL), ndc, psc
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Sqn Ldr RMAU Rathnayake RSP, BSc (Def Stu)

Sqn Ldr KGLK Kapugama RWP,RSP, BSc (Def Stu)

Flt Lt SCB Madurawala MBBS (Sri Lanka)

Flt Lt HMTK Herath

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Registrar SLAF Academy China Bay

Editor of Symposium Journal and Publications

Wg Cdr CK Rajapaksha BSc(Def Stu), MBA(MOT), PMP
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Abreviations

AASL	Airport and Aviation Services Limited
AD	RadarsAir Defence Radar
AD	Air Defence Squadron
ADIZ	Air Defence Identification Zone
ARCC	Aeronautical Rescue Co-ordination Centre
AFCS	Automatic Flight Control System
AFHQ	Air Force Headquarters
AGCS	Advanced Ground Control Station
ALRS	Advanced Launch and Recovery Station
AI	Artificial Intelligence
ALH	Advanced Light Helicopter
ALRS	Advanced Launch & Recovery Station
AMSO	Airborne Maritime Security Operations
ASAR	Airborne Search and Rescue
ATC	Air Traffic Controlling
ATM	Air Traffic Management
BIA	Bandaranaike International Airport
BLP	Berwin Leighton Paisner
CAA	Civil Aviation Authority
CAASL	Civil Aviation Authority of Sri Lanka
CAS	Close Air Support
Cmdr	Commander
CoMPASS	Compact Multi Purpose Stabilized System
DA	Defence Advisor
DASS	Distress Alerting Satellite System
DMC	Disaster Management Center
EEZ	Exclusive Economic Zone
EPAS	Equipment Provisioning and Accounting System
ERMS	Engineering Resource Management System
FAST	Final Approaching Spacing Tool
FAA	Federal Aviation Authority
FAC	Fast Attack Craft
FDA	Federal Aviation Administration
FGB	Fast Gun Boat
FIR	Flight Information Region
FLIR	Forward Looking Infrared
Flt LT	Flight Lieutenant
FMV	Fast Missile Vessel
GCS	Ground Control Station
GERMS	General Engineering Resource Management System
GIS	Geographic Information System
GMRS	German Maritime Rescue Service
Gp Capt	Group Captain
GPS	Global positioning system
HADR	Humanitarian Assistance and Disaster Relief
HEMS	Helicopter Emergency Medical Service
HUD	Head Up Display
ICAO	International Civil Aviation Organization
ICC	International Chamber of Commerce
IFR	Instrument Flight Rules / Instructional Flight Regulations
IMO	International Maritime Organization
INS	Inertial Navigation System
IOR	Indian Ocean Region
IR	Infrared
ISBN	International Standard Book Number
ISIS	Islamic State of Iraq and Syria
ISTAR	Information Surveillance Target Acquisition and Reconnaissance
JDAM	Joint Direct Attack Munition
JFC	Joint Force Command
JOP	Joint Operating Procedure
JSOW	Joint Stand-Off Weapon
KIA	Killed in Action
LGB	Lesser Guided Bomb
LJDAM	Lesser Guided Joint Direct Attack Munitions
ST	Landing Ship Tanker
Lt Cmdr	Lieutenant Commander
MAO	Maritime Air Organization
MBT	Main Battle Tank
MDA	Maritime Domain Awareness
MEDEVAC	Medical Evacuation
MIA	Missing in Action
MRCC	Maritime Rescue Coordination Centre
MSC	Military Sealift Command
MSS	Multi Sensor System
NASA	National Aeronautics and Space Administration
NHQ	Naval Headquarters
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NVG	Night Vision Goggle
OACI	Project Organisation Aviation Civil International
OGE	Out of Ground Effect
OPL	Off-Port Limit
OPV	Off Shore Petrol Vessels
PGMs	Precision Guided Munitions
POW	Prisoners of War
R&D	Resource & Development
RCC	Rescue Co-ordination Centre
RDAF	Royal Danish Air Force
RNAV	Remote Area Navigation
ROE	Rules of Engagement
RSC	Rescue Sub-Centre
SAR	Search and Rescue
SBS	Special Boat Squadron
SD	Spatial Disorientation
SKMSS	Sea King Multisensory Systems
SL Army	Sri Lanka Army
SLCG	Sri Lanka Coast Guard
SLN	Sri Lanka Navy
SLNCG	Sri Lanka Naval Coast Guard
SLOC	Sea Line of Communication
SOLAS	Safety of Life at Sea
SRR	Search and Rescue Region
STABO	Stabilized Tactical Airborne Body Operations
SWOT	Strength, Weaknesses, Opportunities and
TB	Tera bytes
TEUs	Twenty-foot Equivalent Units
TMA	Traffic Management Advisor
TV-guided	Television Guided
UAV	Unmanned Areal Vehicle
UNCLOS	United Nations Convention on Laws of the Seas
USAF	United State Air Force
UU fishing	Unreported and Unregulated Fishing
VBSS	Visit, Board, Search, and Seizure
VMS	Vessel Monitoring System
WDNS	Weapon Delivery and Navigation System
Wg Cdr	Wing Commander

Dissertations

Maritime Joint Operations

IMPLEMENTATION OF A MARITIME OPERATIONS FRAMEWORK

By
Squadron Leader KSUC Ranasinghe
RWP, RSP and two bars, BSc (Def Stu)

Abstract – Since the conclusion of the separatist conflict, the SLAF and SLN have not engaged in a systematic and routine operational framework. This leaves much void in a time where the prime importance of the country's defence posture should focus on being primarily maritime. In analysing the current capabilities and the perceived threat scenario in defence as well as economic perspective, the paper aims to propose the formulation of establishments required to synergise and co-ordinate air and sea assets as well as operationalization. This could ultimately lead on to the formulation of an effective maritime doctrine.

Keywords – SLAF, SLN, Maritime

INTRODUCTION

The Sri Lankan story of the defeat of terrorism is now well known. Though it cost the nation considerably in terms of men and material, it also empowered the military with a wealth of experience that only a few countries can boast of and one which no exercise, demonstration, or simulation can match up to the conflict, which dragged on for nearly 30 years, was predominantly land offensive orientated. This caused the entire military organisation to orientate towards a land based warfare model and thereby the classical force structure was skewed to suit the requirement. As the conflict protracted for nearly 30 years, this model became somewhat permanent thereby shaping the role, task and operational orientation of all three services. This resulted in the Navy and the Air Force being called to play in a supportive role to that of the Army.

Whilst this was the raw fact, it is not true to state that the Navy and the Air Force did not develop its own professional core competencies and operational strengths. Capitalising on these capabilities and emboldened through dynamic thinking with astute leadership, both the Navy and the Air Force have executed some remarkable operations during the course of the separatist conflict, that was completely independent of the Army's requirement, role and orientation. This alone stands as evidence to speak out of the potential that the Navy and Air Force holds in furthering the national cause.

The destruction of floating armouries of LTTE was a key turning point in the conflict against terrorism. Along with the enemy leadership this was one of the key centres of gravity. More than anything else, it underlines the importance that maritime security holds with respect to the island.

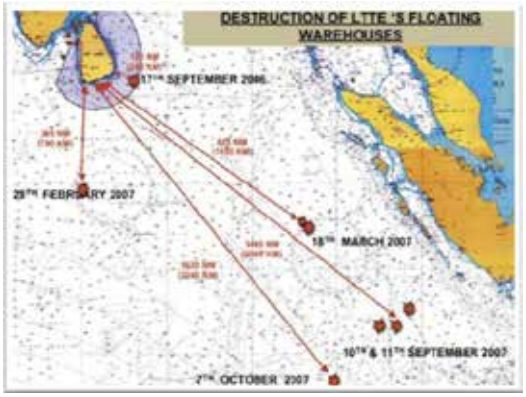

Figure 1: SLN attack map on enemy ships (Source :www.globalsecurity.com)

In the execution of search and destroy operations during the conflict, the SLN and SLAF worked in perfect harmony. In fact, an SLN observer would be part of the crew involved in reconnaissance flights. Furthermore, Air Force personnel were stationed at key Naval bases in order to ensure smooth coordination between Air and Naval operations.

This arrangement worked with remarkable efficiency when it was in operation. However, with the conclusion of the conflict, the same cross operations have ceased driving each service arm to further its requirements independently. It is a sad tale to see that the hard earned experiences are being lost in this way.

Whilst countless examples may be cited, a particular mission is noteworthy. On 17 Sep 2006 the SLAF undertook an interdiction mission 140 nm East of Batticaloa. In doing so it disabled a speeding LTTE arms boat enabling the SLN to close in rapidly and destroy it. This was a classic joint air-sea operation that ensured maritime security.

Figure 2: LTTE Boat disabled after air attack (LTTE boat disabled after air attack, 2015)

Sri Lanka, being an island nation, enjoys the privilege of having no bordering states. On the same lines it means that the sea (surface and the sky above it) will always be the country's first point of contact with the outside world. It will also be the country's first line of defence in the face of external aggression.

Running just around the southern edge of the island is one of the world's busiest shipping routes accommodating ships P lying from the Suez Canal to the Straits of Malacca. This invariably gives the country a responsibility to ensure a safe maritime environment as well as to capitalise the same for its development.

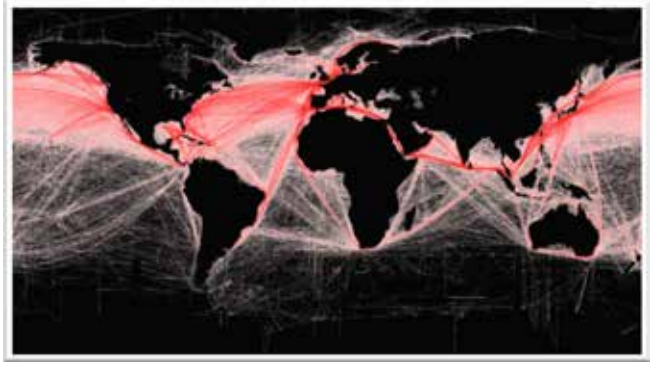

Figure 3: Map of World's Shipping Routes (World's Shipping Routes, 2012)

In addressing all the needs, it is imperative that Sri Lanka holds a strong maritime presence and capability to meet the same. Sadly though, this has been one of Sri Lanka's weaknesses from the medieval era. The sea was always seen as a barrier rather than an asset. Henceforth, to this day, Sri Lanka's maritime presence is considerably weak than other countries, even in comparison with its neighbours.

This, on a very rudimentary analysis, can be attributed to the lack of resources. Naval and Air assets, needed to attain the desirable degree of maritime presence is very expensive. The country is still recovering from the separatist conflict, which drained the state coffers to near extinction, and therefore cannot afford to place its economic weight on a grand re-fleeting exercise for both service organs. Nevertheless, this was a constraint that the Navy and Air Force always faced. Whenever this became the challenge, an out of the box approach has always delivered the desirable. Thus, there is no reason to abstain from applying the same approach this time around. For, there may be no bullets fired, but if not properly managed, a poor state of maritime presence may spell the nation's doom in a modern world which is rapidly developing and moving ahead.

Maritime security is a vital aspect of attracting the world to our doorstep. It is the responsibility of the SL Armed Forces to ensure that the seas and skies above it that surrounds the island are safe and welcoming. Thus it is the need of the hour to brainstorm intensively and establish a comprehensive maritime operations framework which will ultimately lead to a maritime operations doctrine.

Statement of the Problem

The absence of an unambiguous maritime operations framework in a joint environment is a serious risk in ensuring maritime security.

Purpose of the study

The purpose of this study is to identify the areas that need to be addressed in the implementation of a maritime operations framework. It will broadly aim at the core competencies that require to be jointly developed between the two stakeholders in ensuring effective maritime security in Sri Lankan waters.

Research Questions

The following questions will form the guidelines for the compilation of the research thesis.

- What are the key areas that pose a security threat to Sri Lanka's maritime interests?
- What are the core competencies that the Navy and Air Force should develop to address the threats?

Limitations of the Study

The analysis and the recommendations will limit itself to identifying only the core competencies which require an initial integration between the Navy and Air Force. It will further limit from discussing any doctrinal concepts as the same needs to be developed through a joint effort of both stake holders.

LITERATURE REVIEW

Alfred Thayer Mahan. In understanding the vitality of ensuring maritime security the prophecies of Alfred Thayer Mahan stands as a guiding beacon. From as far back as the 17th Century, this US Admiral foresaw the importance of maritime presence in the development of a nation's commerce and published the same in his book "The influence of Sea Power upon history" in 1890. Mahan states. ADM Mahan coined the term "Sea Power" to denote the maritime presence in a militaristic perspective that a nation requires to hold in order to ensure effective maritime security. In this he identifies six conditions that affect a nation's sea power.

- Geographical Position.
- Physical Conformation, including, as connected therewith, natural productions and climate.
- Extent of Territory.
- Number of Population.
- Character of the People.
- Character of the Government, including therein the national institutions. (Mahan, 2004)

Sri Lanka's current position can be easily evaluated using the above stated guideline which was prophesized nearly three centuries ago. The importance of Sri Lanka's position can be aptly summarised by Mahan's comment "Whoever controls the Indian Ocean dominates Asia. This ocean is key to seven seas. In the twenty-first century, the destiny of the world will be decided on its waters".(Abraham, 2014)A broad approach will be made on the above lines during the analysis of the paper.

Strategies: In order to ascertain the role of the Air Force in ensuring maritime security, it is vital to observe what areas in a conventional maritime military strategy can be addressed through the capabilities achieved in the execution of an air strategy. The guidance framework is taken from the Indian maritime and air strategies.

In analysing the capabilities of an Air Force, the main characteristics of Air Power that stand out are Height, Speed and Reach. The superiority that an aerial platform holds over a land or sea based platform in respect of the above is the main thrust behind the employment of these assets which otherwise remains a costly affair.

In employing an Air Strategy, an Air Force will hold the ability to execute the following campaigns / operations in its Air Strategy.

- Counter Air Campaign
- Counter Surface Force Campaign
- Strategic Air Campaign
- Combat Enabling Operations - Air/Ground (IAF : 2012)

Under Combat Enabling Air Operations an Air Force may undertake the following

- Air Transported Operations
- Air to Air Refuelling
- Surveillance and Reconnaissance
- UAV ops
- Airborne Early Warning
- Electronic Warfare
- Search and Rescue (IAF :2012)

Of the above the areas of interest remains Air Transported operations, Surveillance and Reconnaissance, UAV Ops as well as Search and Rescue.

- On the other hand, a Navy will be employed in the following four roles.

- Military – A wartime task of projecting military power.

- Diplomatic – Use of maritime forces to support national political objectives and foreign policy.

- Constabulary – Maintaining “good order” at sea.

- Benign – Humanitarian Assistance and Disaster Relief (HADR) (Ranganathan :2011)

In the above, the pursuance of military power as well as diplomatic roles will be intrinsically naval in nature. The area of interest here would be the Constabulary and Benign roles.

In the constabulary role a Navy would be called upon to perform the following operations.

- Low intensity Maritime Operations – Use of military power against state as well as non-state actors undertaking anti national activities.
- Anti-terrorism operations.
- Anti – Piracy operations.
- Anti-trafficking operations (human, drugs, arms)

In the Benign role, a Navy is called to perform the following operations.

- Humanitarian assistance and disaster relief
- Building maritime consciousness
- Hydrography
- Non-combat evacuation (Indian Navy :2007)

An analytical approach would find how best the two domains can be married in order to identify the best possible resource and capability mix.

SLAF Vision, Mission, and Core Competencies

In order to identify what the SLAF projects for itself it is prudent to take a look at the organisations guiding framework

- Vision – Ensuring National Security through effective employment of Air Power
- Mission - To train, equip and deploy a professional Air Force exploiting our core competencies to undertake air operations in support of National Security
- Core Competencies
    - Air Defence
    - Surveillance and Recce
    - Electronic Warfare
    - Air Strike
    - Air Transport
    - Force Protection
    - Constant Readiness
    - Rescue
    - VVIP Transport
    - Cyber Warfare (www.airforce.lk)

METHODOLOGY

Hypothesis

This paper builds upon the following hypothesis. “The formulation of a joint operations mechanism(s) would be the best avenue to implement an effective maritime operations framework”

Design

As the research cannot be based on individual desirous opinions, a survey to reflect the same amongst a sample population was not carried out. On the contrary, the current scenario was analysed and the recommendations will come out with the proposed framework.

As such the paper will follow an exploratory design. The main objectives will be to identify the key areas on which the joint capabilities should be achieved.

Limitations

As the study is purely based on the current operational capabilities of two armed forces, and the proposals cannot be tested in real time, the success of implementation is beyond the possibility of analysis.

CURRENT SCENARIO

Maritime Domain Awareness

Maritime Domain Awareness (MDA) is broadly defined as the effective understanding of any activity associated with the maritime environment that could impact upon the security, safety, economy or environment (www.imo.org, 2008) Thus it is imperative to identify the maritime environment, which lies within the interests of Sri Lanka.

Territorial Waters: As defined in the United Nations Convention on the Law of Seas (UNCLOS), a nation's territorial waters will extend 12 nautical miles from its baseline. The Contiguous Zone extends up to 24 nautical miles from the baseline. A nation holds sovereignty over territorial waters whilst it may exert control necessary to prevent the infringement of customs, fiscal, immigration and sanitary laws of the country. (www.un.org, 2015)

The territorial waters coincide with the Air Defence Identification Zone (ADIZ) established for the purpose of ensuring Air Security over the island. (Airport Aviation Services Sri Lanka, 2013)

The Exclusive Economic Zone (EEZ): As defined through the UNCLOS, the country's EEZ extends to 200nm from the baseline. However, where the distance between two countries is less than 200 nm, it is generally accepted that a line drawn equidistant to the shorelines of the two countries are taken as the limit of the EEZ

Sri Lanka's claims are expected to increase up to approximately 75,000 Km^2 with the delimitation of the continental shelf claim which is an ongoing process.

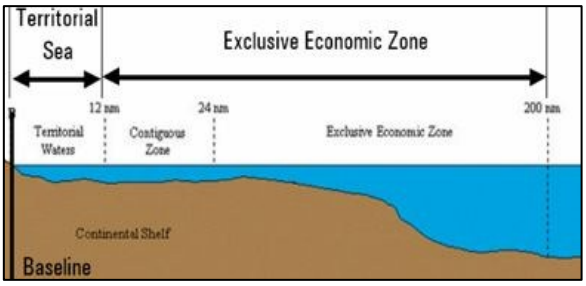

Figure 4: The Waters of a Nation
(World Customs Organization, 2012)

Figure 5: Sri Lanka EEZ
(Sri Lanka EEZ, 2012)

Figure 4: The Waters of a Nation
(World Customs Organization, 2012)

Flight Information Region / Search and Rescue Region. – All airborne traffic that originate from and arrive to the country fall within the responsibility of the country when it enters the Colombo Flight Information Region (FIR). Sri Lanka is duty bound to carry out search and rescue in the

event of a disaster that takes place within the bounds of the FIR and thus the area duplicates as the Colombo Search and Rescue Region (SRR) (Airport.lk, 2015)

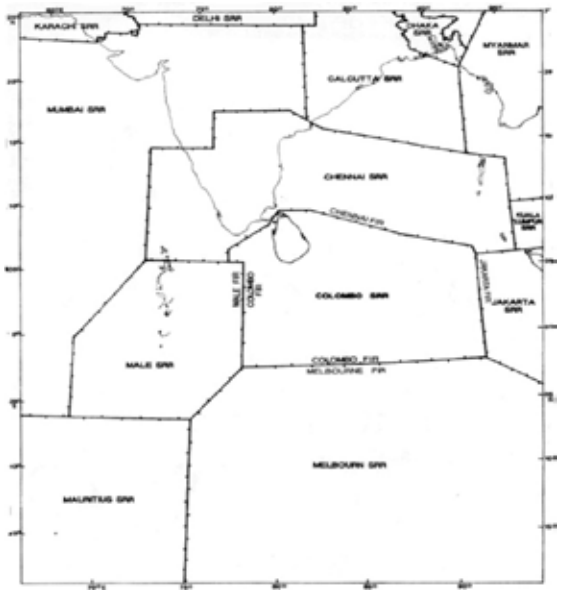

Figure 5: Map of Colombo FIR and SRR (Airport Aviation Services Sri Lanka, 2015)

Based on the above mentioned delimitations, it is clear that the maritime area of responsibility that falls within the purview of Sri Lanka is enormous. Henceforth it would require a co-ordinated, concrete and meticulous effort in order to ensure effective security.

Sri Lanka Air Force: This is the executing agency of the nation's air strategy. The Sri Lanka Air Force (SLAF) operates the following types of aircraft.

In the fighter / fighter trainer role

- Kfir C2
- F 7
- K 8

In the transport role

- C 130
- AN 32
- Y 12
- MA 60

In the reconnaissance role

- Beechcraft B 200
- Searcher Mk II UAV

In the attack helicopter role

- Mi 24
- Mi 17

In the utility transport role

- Bell 412
- Bell 212

In the trainer role

- Cessna 150
- PT 6
- Bell 206

All these aircraft are distributed across 10 flying squadrons located at six airbases around the country. They operate under the direct authority of Air Force Headquarters. In addition to organisational requirements, tri services commitments are met on the approval of the Ministry of Defence.

Out of the entire aircraft fleet of SLAF the transport and reconnaissance aircraft fleet stands as the prime candidate in increasing the maritime air presence. Whilst no dedicated maritime patrol aircraft are available with the SLAF, the transport aircraft possess the range and endurance for a long range long duration flight. This ability is augmented by the UAVs. The fighter aircraft in the inventory are capable of interdicting any target within the EEZ as it has been repeatedly demonstrated during the humanitarian operation. The downside is that SLAF does not hold aircraft in sufficient numbers to sustain a protracted maritime operation. Hence, a marriage of platforms would yield synergistic results.

Joint training exercises with the Army and the Navy are undertaken on special trainings which are planned in advance. The Annual Exercise "Cormorant Strike" is designed to recreate the combat scenarios experienced during the concluded conflict so that the combat edge of the military especially that of the ground troops are not lost. However, this being the cynosure of military exercises does not focus on Naval – Air specialist operations.

In the same lines, special Navy – Air Force joint trainings are also carried out, codenamed Exercise Flash Style. In addition to the Sri Lankan militaries, the US Navy is also added on to participate in the event. This is the only rudimentary operational link that prevails between the Navy and the Air Force. (www.airforce.lk)

Sri Lanka Navy (SLN). The Sri Lanka Navy Operates the Following Classes of Vessels.

- Sukanya Class / Cutter Class Offshore Patrol Vessels.
- Landing Ship Tank
- Bay Class patrol boats
- Sa'ar Class Fast Missile Craft
- Dvora / Super Dvora Fast Attack Craft
- Fast Gun Boats
- Littoral crafts – Water jets (www.navy.lk)

The performances of assets (both of the SLAF and the SLN) that are committed to S&R are listed in Annex A.

The SLN undertakes coastal and deep sea patrolling using the resources at hand.

Other Stakeholders

In addition to the two military organs, the following organisations are seen as stakeholders in building a comprehensive maritime picture.

Airport and Aviation Services Limited

In the possession of surveillance radar coverage for all commercial air traffic within the Colombo Flight Information Region (FIR). Furthermore Air Traffic Controlling and alerting services with respect to all airborne traffic within the Colombo FIR is provided by AASL.

Civil Aviation Authority of Sri Lanka (CAASL)

Holds the responsibility of ensuring the execution of Search and Rescue in the event of a disaster within the Colombo FIR as per the ICAO guidelines. The CAASL is dependent upon the SLAF and SLN for assets and it is also the bounden duty of the latter agencies to provide the same in the event of a requirement. (www.airport.lk)

Sri Lanka Coast Guard

Sri Lanka Coast Guard (SLCG) functions under the Ministry of Defence. It is a non-military law enforcement agency at sea. Every Coast Guard officer of the Department of Coast Guard shall be deemed to be a peace officer within the meaning for the purposes of the Code of Criminal Procedure Act No. 15 of 1979. SLCG has been empowered with legal authority to search and arrest ships, craft and personnel engaged in illegal activities in maritime zones and the territorial waters of Sri Lanka and constitute legal proceedings against the offenders.(Coastguard.gov.lk, 2015)

Ministry of Fisheries

Continuous surveillance of fishing vessels through the newly installed Vessel Monitoring System has now become a critical component of ocean based surveillance in terms of security.

Infrastructure in Place

At present, some of the areas with respect to maritime operations have been addressed through the following infrastructural facilities.

Air Rescue Coordination Centre (ARCC) – Functioning under the Director General Civil Aviation. This is the contact point in the event of an Air disaster within the Colombo FIR. It will then alert the SLAF and SLN for search and rescue operations. The ARCC is currently located at Ratmalana.

Maritime Rescue Coordination Centre (MRCC) – Functioning under the SLN. This receives inputs from Naval Radars around the island, Ocean traffic through the Automatic Identification System, Details of fisheries vessels through the VMS, as well as satellite and internet based surveillance data. In the event of distress, Naval assets are deployed for search and rescue.

Colombo Area Air Traffic Control – Functioning under the AASL, this operates a Secondary Surveillance Radar which gives a comprehensive picture on all airborne traffic within the FIR.

Threat Perception

Based on the modern day trends, the current threats are percieved to befall Sri Lanka based on a maritime based perspective.

Piracy – Pirate attacks stemming from the Horn of Africa (Predominantly Somali origin) have been recorded as close as 1000 nm from Sri Lanka with isolated incidents being reported as close as 300 – 200 nm. (www.bluebird-electric.net). As the country aspires to reap the benefits of the Suez – Malacca shipping route that lies in close proximity, eradicating the menace of Piracy within Sri Lankan waters is a enticing magnate to ship operators.

The importance in securing the Sea Lines of Communication (SLOC) was aptly summarised in the following compilation. “The region can be starved to death merely by disturbing our Sea Lanes of Communications. Transiting more than 80% of world’s seaborne trade through Indian Ocean choke points is a clear fact to prove this very fact. The military starvation Sri Lanka Navy adopted by destroying LTTE’s shipping network as well as taking total control of our Sea Lanes of Communications is another example to prove the importance of focusing on our Sea Lanes of Communications”.(Wijegunarathna:2015). Sea piracy since 2007 has become a significant impediment

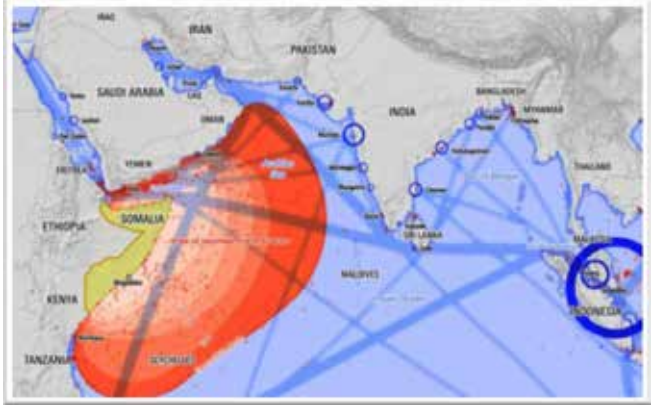

Figure 5: Map of Colombo *FIR and SRR*

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Sea piracy since 2007 has become a significant impediment to global maritime commerce. The estimated annual cost of piracy to global economy is around USD 7 to 12 billion. The projected cost of piracy by 2014 is USD 13-15 billion. In 2010, 86% of piracy activities worldwide were committed by Somali pirates. The numbers slightly decreased in 2011, but remained alarming at 62%. According to the International Chamber of Commerce (ICC), there were 439 pirate attacks worldwide in 2011 and up to middle of September this year it was 225. The instability prevailing in inland Somalia has transcended to the high seas including West coast of India and South as Mozambique Channel. (Wijegunarathna:2015)

Where due cognizance is paid to this aspect, it becomes imperative on the militaries with a maritime presence i.e. the Navy and the Air Force to ensure that Sri Lankan waters are safe for commercial shipping. Thus it is a prime economic threat to be percieved in the future.

Poaching

Significant challenge that the country faces is the persistent threat posed by Indian fishermen who venture out to Sri Lankan waters for fishing. These fishermen engage in bottom trawling, which is a banned method under Sri Lankan law, destroying the sea bed. This causes irreparable damages to the delicate marine environment in the shallow waters of the Mannar basin.

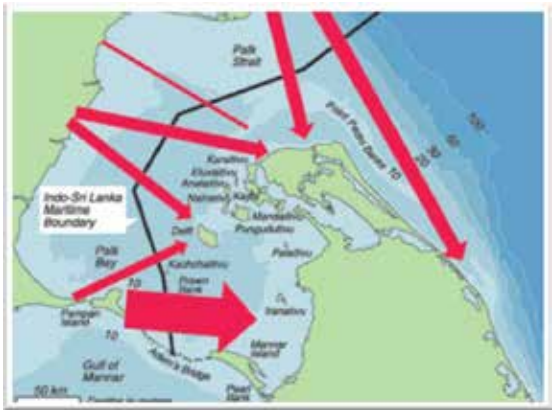

Figure 7: Patterns of Poaching by Indian Fishermen (Source: www.sundaytimes.lk)

Notwithstanding this issue, the broad gamut of poaching is far reaching. Sri Lankan waters are abundant with marine life. Enticing sights such as whales have been spotted off the coast of Trincomalee and Kalpitiya. Hence, in an undetected scenario, no one knows which other nationalities engage in large scale industrial poaching in Sri Lankan waters. (Serge Raemaekers, 2015)

Marine Pollution

From aerial surveillance by governments around the world, we can see that illegal dumping by commercial ships is commonplace. 5% – 15% of all large vessels are believed to break the law by discharging waste oil into the oceans. The world’s shipping fleet is comprised of nearly 88,000 vessels. About 50,000 of these ships trade internationally. It is believed that 85-90% of the world fleet complies with the law. Unfortunately, that means that the remainder, some 5,000-7,500 vessels, routinely and intentionally pollutes the seas. Estimates of illegal dumping range from 70 million to 210 million gallons of waste oil spilled into the world’s waters each year. (Marinedefenders.com, 2015)

In the absence of an effective maritime surveillance network, the waters of Sri Lanka are open to rampant abuse. Only swift, effective and decisive action will be useful in preventing the same.

Staging grounds for powerful nations

A purely hypothetical situation. In the absence of a sound surveillance system over the waters of Sri Lankan interest, the waters may turn into lurking grounds for powerful nations with a strong naval presence. This would transform Sri Lankan interests into staging grounds where these nations may use their power either against Sri Lanka or against one of our neighbours. This would cause an unpleasant scenario in the regional political balance as well as could lead to Sri Lanka being sudjugated to surveillance of a different power.

Inability to respond to a natural or man made disaster

The MH 370 disaster was a glaring eye opener as to the magnitude of effort that would be needed in the event of a maritime disaster in the Indian Ocean. The inability to respond in a timely and sufficient manner would lead to a serious backlash of the country within the global community. (The Sunday Times, 2014)

RECOMMENDATIONS

Based on the above stated threat perception, and in analysis of the capabilities of the two services, the following recommendations are put forward. This is the basic operational framework to be implemented in order to achieve the basic degree of maritime security.

The implementaiton of a maritime operations framework will be focused upon the following three core competencies

- Maritime Reconnaissance
- Search and Rescue
- Maritime Security Enforcement

As such the detailed proposals will fall according to these core competencies.

Establishment of a Joint Surveillance Agency

Maritime surveillance is a wide area that requires continuous effort draining a consierable volume of resources. The capabilities, expertise and exposure of both the service organs can be harnessed together and synergised to achieve a greater presence. This can be done by establishing a joint maritime surveillance centre which will be manned by personnel from both services. The surveillance inputs from all platforms such as reports from patrol ships, communication with surveillance aircraft as well as live video feed from UAV flights will be channelled into this centre in order to obtain a comprehensive surveillance picture of the country. A thorough analysis may then be made on the situation as the same develops. Command and Control of this centre may be determined upon detailed deliberation of the establishment so as to achieve maximum efficiency. This may later be linked with regional surveillance centres to ensure greater co-operation and a more sound surveillance setup in time to come.

Formulation of a Joint Operations Procedure

Taking line from the Joint Surveillance Centre, the main stake holders of the operation namely the SLAF and the SLN together with other relevant parties mentioned ealier in the paper, should formulate a Joint Operating Procedure (JOP) to streamline the operation. The JOP would spell out Command and Control, Asset utilisation, Information verification and Media coordination. In the absence of a Naval Aviation Unit, the SLN capability is limited to that within the visual range of a vessel. Thus it is the best mix to synergise operations between the SLAF and the SLN through the JOP. As it has been achieved in the past during offensive operations, it is only a matter of time and practice until harmonised operations are regained between the two services.

Extending the range of UAVs.

Currently the UAV capability of the SLAF is limited to the ground control station range. However, if a similar station can be installed in a SLN Ship, the range can be extended by an equal magnitude. Thus the UAV, with its extended endurance, the UAV could stand to serve the maritime domain on a wider scale and on the same value magnitude that it did during the separatist conflict.

The challenge in this respect would be the establishment of a direct data link with the UAV to remain with the near real time picture even whilst under control of the ship borne station and well away from land. The only plausible option here would be to link through satellites where communication is possible in the Ku band provided that the country is able to secure the services of a reliable satellite either through a self venture or a friendly country.

Establishment of a Joint Search and Rescue (SAR) Centre.

The Malaysian Airlines MH 370 disaster had opened the eyes and shown that Sri Lanka possesses no capability to respond to such a calamity. (The Sunday Times, 2014) In this light, whilst the present asset base would definitely require enhancement, a joint search and rescue plan would result in a more co-ordinated and time critical rescue operaiton. This would also facilitate joint training and would identify the key competencies that would need development. Novel methods such as the Fulton Recovery System is one example.

Maritime Security Enforcement

Should there be an undesirable presence within the Sri Lankan area of interest, the SLAF and SLN should possess the capability to remove the same. For this a deterrant element should be present in the ranks. Henceforth, in an aerial perspective, a maritime strike ability should be retained with the SLAF offensive capability.

CONCLUSION

The maritime domain is indeed, a vital area that has been long neglected in Sri Lanka's defence posture. Irrespective of the fact that the country is at peace, the defensive posture should always remain alert, attentive and up to date.

The ocean is the country's first line of defence. Sri Lanka suffered unimaginably in the hands of European sea faring nations due to the fact that the country did not possess its own maritime defence. The painful lessons learnt in history should be borne significantly in mind and be held to the highest in deriving courses of action for the future.

Other than the experience shared during the separatist conflict, the SLAF and SLN have not synergised on a routine and systematic operational framework. The proposed functionalities aim to bridge this virtually non existent establishment within the two arms. The jointness which would be developed from thereon would stand to serve as the base for a future development of a joint air-sea maritime operations doctrine.

ACKNOWLEDGEMENT

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UTILIZATION OF SLAF HELICOPTERS IN JOINT OPERATIONS TO COMBAT ILLEGAL SEA ACTIVITIES AND IN PROTECTION OF MARITIME RESOURCES

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Abstract — Sri Lanka being an island nation claims for a vast area of sea which comprises of abundant maritime resources, and due to the same reason, encounters threats to the sovereignty and nation building, such as illegal fishing, human trafficking and smuggling as priorities. At present Sri Lanka indulges the freedom of a sovereign nation after an absence of 30 long years and focuses towards nation building at large.

Further, the past experiences provide ample evidence for the requirement of joint and well-coordinated actions of all state defence/security organizations in this attempt. Therefore, this paper intended to ascertain the probable contribution of Sri Lanka Air Force (SLAF) helicopters in joint operations to combat illegal sea activities and in protection of maritime resources.

Utilizing the SLAF helicopters in the above role required detailed analysis of the present and future context of the maritime environment and in-depth scrutinizing of the core competencies of the helicopters which are in current operation. This was to set a benchmark on the level of deployment for SLAF helicopters in coordination with other organisations.

In order to make this a successful research paper, the authors were compelled to study the capabilities of the machines, in which aspect of the operation it could be efficiently deployed the supportive equipment which caters best in this context, the procedure followed by the other nations in this respect and finally the competency level and training of the pilots with regards to maritime operations.
Main concentration of the researchers was the four helicopter squadrons of SLAF. Main source of literature were the flight manuals and the existing Standard Operating Procedures of the squadrons and the rest will be open source. Further, hard and soft written materials on the respective subject matter were referred and discussions with the personnel who possess experience in maritime operations added more insight to the research.

Analysis of data was done at the end of the data collection as a comparison between the set standards and the actual existing standards. Finally, the attempt of the researchers was to comprehend the expected level of contribution of the existing SLAF helicopters, in joint operations to combat illegal sea activities and protection of maritime resources. Further, appreciated the next level, the SLAF helicopters required to attain in the future in this regard.

Keywords: SLAF helicopters, maritime resources, joint operations

INTRODUCTION

The ocean that surrounds Sri Lanka, with its challenges of distance to cover and risk involve in that has shaped, and continues to shape, the island nation. Both through its constraints and opportunities, it has been a fundamental influence on the economic development, trade and industry infrastructure, culture and the sense of belongingness, and of course, the strategic priorities.

The security of the community, nation's economy and the integrity of environment can all be threatened by illegal activities such as human trafficking, unreported and unregulated fishing exploitation of natural resources, illegal activity in protected areas, unauthorized maritime movements, prohibited imports/exports, maritime terrorism, piracy, compromise to bio-security and marine pollution.

The continuation of this activity will have an impact on national interest against maritime security threats in Sri Lanka's offshore maritime domain. Over recent years, many states have stepped up efforts against human trafficking, the shortcomings in systems contributes to the continuation. The political will, operational capacity, knowledge on trafficking and counter-strategies work best for the nation are lack in the system in case of Sri Lanka. As a consequence, human trafficking continues to thrive.

The offshore oil and gas explorations carried out during the recent past have discovered existence of potential oil and gas fields. Therefore, in the future this will pose a new and additional maritime security threat for the government of Sri Lanka.

Maritime security is important for exploiting maritime resources, securing livelihoods and development. It should be framed within national and regional policies that go beyond immediate needs and reactive engagement. Therefore, the capacity to provide air assets in fighting the above mentioned illegal activities to support law enforcement at sea and in coastal areas is a significant part of maritime security capability of Sri Lanka

STATEMENT OF THE PROBLEM

The requirement of effective utilization of SLAF helicopters with possible upgrades in joint operations to counter the illegal sea activities and protect maritime resources in Sri Lankan seas.

METHODOLOGY

The study was based on qualitative data collection. Such as Aircraft manuals and Standard Operating Procedures of the Helicopter Squadrons, the secondary data were from printed media articles, magazines, newsletters and books. In addition to that, documents of other Air Force and defence forces, research papers and reports were also collected. Further, discussions were carried out with some Officers of Army and Navy who are having experience in different maritime operations. The collected data were analysed to find threats for Maritime resources and security. Finally, the authors build up a discussion and came up with some suggestions as to how the SLAF helicopters can be employed in joint operations with the other relevant authorities.

COLLECTION OF DATA

The Sri Lanka Air Force has vast experience in employing of helicopters in counter terrorism. This includes operations over land as well as over the sea. For example, Mi-24 gunships were employed for providing escort to the Jetliner ship during conflict era and Bell 212s and Mi-17s were engaged in maritime surveillance duties. Further, some limited experience of utilizing Bell 412s to convey the crews, to and from the offshore oil exploration platforms.

Fighting during a separatist war in mainland and engaging in maritime security flying for the purpose of policing are totally different aspects of flying. Either be it the terrain or the type of missions flown, there are major differences with respect to the machine and the man behind the machine. Therefore, employment of helicopters in Maritime security needs more deliberation.

Acclimatizing with the present maritime context of Sri Lanka is a prerequisite for the study. The areas demarcated are as follows:

- Territorial sea: 12 nm (22.2 km; 13.8 mi)
- Contiguous zone: 24 nmi (44.4 km; 27.6 mi) Exclusive Economic Zone: 200 nm (370.4 km; 230.2 mi)
- Continental shelf: 200 nm (370.4 km; 230.2 mi) or to the edge of the continental margin

Figure1: Maritime boundaries of Sri Lanka

Understanding on the illegal sea activities taking place in Sri Lankan maritime domain was the next requirement for the study. Such activities are;

Illegal Unreported and Unregulated (IUU) Fishing

This is one of the crucial issues faced by Sri Lanka since lately. The main maritime resource in Sri Lankan waters is the fish resource. Since the ocean is around the country, the fish is abundant, but illegal fishing around the island is escalating day by day.

Even though Sri Lanka is an island nation which is surrounded by Indian Ocean, the protection and monitoring the vast area are merely impossible with the small number of vessels operated by SL Navy and Coast Guard.

Intelligence sources inform that large number of fishing trawlers from other countries do illegally operate within Sri Lanka EEZ to catch fish. Specially the South Indian fishermen illegally encroach in to the North Western, Northern and North Eastern seas and illegally catch the fish harvest which is a significant threat to the livelihood of local fishermen which necessarily should belong to Sri Lanka.

Figure2: Area of poaching by Indian fishermen

Smuggling

Since Sri Lanka is strategically located in the Indian ocean, it's a gateway between the East and West of the world map and smuggling has become a major threat to the country as well as the other countries which are destinations of the goods, transit through Sri Lanka.

Close proximity to South India makes the situation worse, since small boats can be operated between the western coast of Sri Lanka and South India for illegal trade of narcotics and other contrabands. The coastal belt between Mannar and Negambo is the main smuggling paradise in Sri Lanka.

Further, the 2014 'World Drug Report' provides details pertaining to the regional trend in drug use. The data pertaining to Asia suggest that consumption of illicit drugs is at levels similar to or below the global average. Drugs can simply defeat a country without waging a war. The damage caused by drugs to the younger generation is enormous and irreversible.

Smuggling of weapons has become a serious security issue. There is enough evidence to prove the links these weapon smuggling groups have with pirates, human smugglers, terrorists, drug traffickers, document fraud, money laundering and various other transnational crimes. When these weapons are smuggled via sea routes, apprehension becomes a mammoth task due to the vastness of the ocean space.

Human Trafficking

After the end of the humanitarian operation, terrorists who escaped the capture from the government forces started illegal migration either to Europe or Australia as asylum seekers. And even before that this practice was there which necessarily originated from Negambo, where people tend to cross the seven seas in order to find green pastures to destinations like Italy.

This was totally illegal, life threatening and treacherous. There was no assurance about the life whatsoever. These voyages are discretely planned and executed very clandestinely which makes them really hard to catch.

As the coastal area is so vast around the island, protection which could be imposed on human trafficking is bare minimal. The boats /trawlers used to carry out human trafficking, very often get capsized or end up in disaster posing threat to human life.

It is discovered three points of departure: Udappu (Puttalam), Vettilaikkerni (Jaffna) and Salli (Trincomalee), all of which are Tamil areas. Regardless of where they depart from, most boats eventually go through Trincomalee Harbor. (Troubled Waters: Corruption and Human Trafficking in Post-war Sri Lanka 2012)

The report done by SL Navy with regards to the maritime security of Sri Lanka also clearly depicts the real danger of the present situation.

Maritime Terrorism

Maritime terrorism was prevalent in the region and Indian waters since mid-1980's due to the absence of an effective maritime safety mechanism. Cross-border terrorist networks are operating across the Middle-East, Central Asia, South Asia, and South East Asia. Among the few terrorist organizations which have acquired maritime capabilities, the Liberation Tigers of Tamil Eelam (LTTE) stood as the most effective group until their defeat.

Maritime Piracy

Prior to Somali piracy, many ships used to call on a number of ports in the Eastern coast of Africa. As piracy began to spread in the Somali waters, ships began to reroute towards harbours in the West. The Colombo port was benefitted immensely due to this. Therefore, the possibility of spreading piracy activities in to Indian Ocean is high. (Sri Lanka-the littoral state: its significance and role in maritime security in the Indianocean2015)

In addition to the above future possible offshore oil rigs could be faced threats. Attacking offshore oil and gas installations is not a new phenomenon. These include terrorists, insurgents, pirates, criminal syndicates, environmental activists, anti-oil activists and other types of protesters, hostile Nation-States, and sometimes other unknown groups and individuals. The attacks may come from various sources: individuals or groups internal or external to a state or a combination of both. This threats faced by offshore oil and gas installations based on activity type. The categories utilized are;

- Piracy
- Terrorism
- Insurgency
- Organized crimes
- Civil protest
- Inter-state hostilities
- Vandalism and Internal sabotage

To face these treats it is need to identify the existing capability of SLAF especially the helicopters in the inventory as the paper focus on that.

The following are the different types of twin engine helicopters in SLAF inventory and used for the purpose of maritime aspect:

- Bell 212
- Bell 412
- Mi-17
- Mi-24

Other than the Mi 24 all other three helicopters consider as utility/ medium lift helicopters. Mi24 is an attack helicopter fitted with the Compact Multi Purpose Stabilized System (CoMPASS) which is equipped with a camera, Forward Looking Infra-Red and laser range finder. The system is used for observation, directing, detection, designation, range measurement, acquisition and tracking of sea, air and surface targets. The system is capable of operating around the year, under variable visibility conditions (at day and night).

Other than the Mi 24 all other three helicopters consider as utility/ medium lift helicopters. Mi24 is an attack helicopter fitted with the Compact Multi Purpose Stabilized System (CoMPASS) which is equipped with a camera, Forward Looking Infra-Red and laser range finder. The system is used for observation, directing, detection, designation, range measurement, acquisition and tracking of sea, air and surface targets. The system is capable of operating around the year, under variable visibility conditions (at day and night).

However, converted cockpits for the use of Night Vision Goggles (NVG) in SLAF helicopters and experienced pilots on NVG operations are very limited at present.

The capabilities, equipment and availability of helicopters are indicated in the following tables.

Aircraft	Range	Radius of Action (Without Auxiliary fuel tanks)	Radius of Action (With Auxiliary fuel tanks)
BELL 212	237 Nm (439 km)	1500 Lbs 118 Nm (220 km)	Not avlb
BELL 412	237 Nm (439 km)	331 US gal (1,251 L) 118 Nm (220 km)	Not avlb
MI-17	465 Nm (251 km)	2500 L 124 Nm (230 km)	(2500 L + 915 x 2) = 4330 L 215 Nm (400 km) (2500 L + 915 x 4)= 6160L 306 Nm (570 km)
MI-24	243 Nm (450 km)	2100 L 121 Nm (225 km)	(2100 L + 475 x 4)= 4000L 232 Nm (430 km)

Table 2: Radius of action of SLAF helicopters

Item/ Helicopter	Bell 212	Bell 412	Mi-17
Floatation System	Not Available	Available	Available (not on military versions at present)
Winch (capacity and cable length)	600lbs (250ft)	600lbs (250ft)	150kg(40m)
			300kg(60m)
			(not available with the helicopters in the country at present)
Abseiling/ Fast roping (number of soldiers at once)	08 soldiers	08 soldiers	20 soldiers (Fast roping not possible due to unavailability of attachment)

Table 2: Specialist equipment's and Abseiling capability of SLAF helicopters

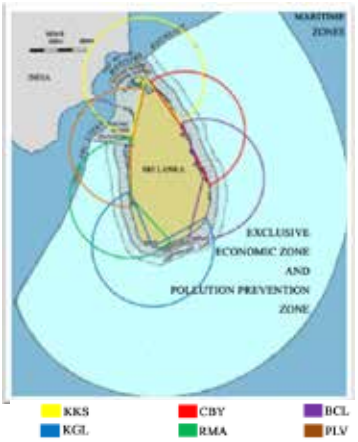

Figure3. ROA of Mi-17without auxiliary fuel tanks (not considering for loitering time)

Figure4:ROA of Mi-17 with 02 x auxiliary fuel tanks (not considering for loitering time)

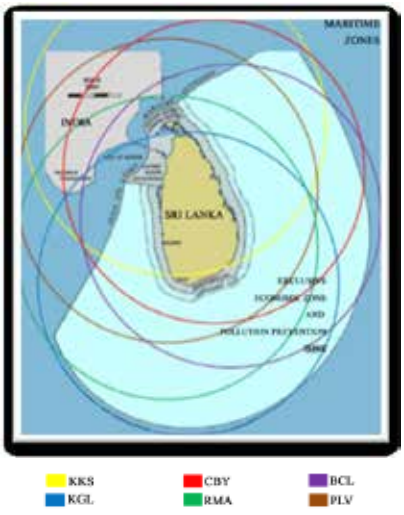

Figure5:ROA of Mi-17with 04 xauxilary fuel tanks (not considering for loitering time- in this configuration it is not possible carry any passengers on board other than the crew members)

Type/ Sqn	No 9 Squadron	No 7 Squadron	No 4 Squadron	No 6 Squadron
MI-24	(11 O/H Due) 03 on progress for O/H	-	-	-
Mi-17	01 x Mi 171V Military mission capable	-	02 (MI 171E Saloon) Not capable to utilized for Military mission	02 x Mi 171E and 01 x Mi 171V at Anu 05 x Mi 171E and 01 x Mi 171V at Rma Only 02 are Military mission capable (01 Rma + 01 Anu) Mi 171E could be utilized for visual recce- flotations also available
Bell 212	-	3 at Hin / 01 at KKS Military mission capable	01 Military mission capable	-
Bell 412	-	-	07(412 EP x 04 + 412 x 03) Only 01 Military mission capable	-
Note: Mi 17- 02 x Internal Auxiliary tanks are available, external auxiliary tanks are not available at present (08 x available with UN Mission helicopters)				

Table 3: Availability Of Helicopters

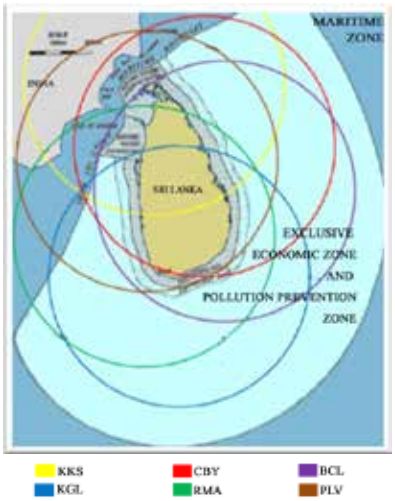

Figure6: ROA of Mi- 24 with external auxiliary fuel tanks (not considering for loitering time)

Not any of the above helicopters are dedicated for maritime role. The manufacturers have built them for a general role and task. But still there are few provisions, to partially modify them for another role and task on requirement. But as mentioned above, in a multitasking environment, these helicopters were used to carry out some of the tasks in maritime environment. In the process of carrying out above tasks, the helicopters are to be equipped and upgraded, in line with the particular role and task.

Utilizing the attack/armed helicopters inland or maritime border protection is a common practice. Literature survey provided details on utilizing Mi-24 in Maritime surveillance by Air Wing, Republic of Sierra Leone Armed Forces in concert with Maritime Wing(The Republic of Sierra Leone Armed Forces–Air wing 2015)and Qatar Emiri Air Force's decision to purchase AH-64E Guardian attack helicopters for border protection and to enhance the protection of key oil and gas infrastructure and platforms. (Qatar: The Emir's New Helicopters 2014)

In a joint environment the Sri Lanka Army Commando and Special Forces diving units, Navy Small Boat Squadron are capable of deploying for different operations by air. The Rig and Drop training is carried out regularly using Mi-17 to deploy special operation forces personnel and inflatable boats utilizing Mi-17s. However, it is difficult to use these boats in deep sea operations and therefore it is not practical to carry out Rig and Drop operations in case of antipiracy operations. These operations could be useful in anti-smuggling and to counter Human Trafficking in North Western part of the sea. The most commonly used Rigid-Hulled Inflatable Boat(RHIB)in antipiracy operations are too large to carry in any helicopter type in the SLAF inventory for a rapid deployment in the sea.

The other option is to operate the helicopters from landing deck of a ship in case of deep sea operations. From the presently available Offshore Petrol Vessels (OPV) of the Sri Lanka Navy only 3 having the landing deck for the helicopters and the sizes are;

- SLNSayura- 22.3m x 10 m
- SLNSagara- 14.5m x 11.3m
- SLNSamudura- 18.4m x 8.8m

Only smaller helicopters(mostly single engine) are capable to operate from these decks. The requirement of helipad dimensions for the SLAF helicopters are;

- Bell 212/ 412- 35 m X 35 m
- Mi 17- 35m X 35m
- Mi 24/35- 50m X 50m

As such the sizes of the available landing decks of OPVs are not sufficient for the existing SLAF helicopters to land on them.

Through the literature survey it was found an alternative solution for the unavailability of naval ships capable of carrying helicopters and the financial constraints of acquiring dedicated helicopter carrier. United States Military Sealift Command (MSC)converted one cargo ship to a "Maritime Support Vessel" which allows the vessel to function as a floating base for up to 200 troops and their weapons plus small boats, helicopters and the jet skis is an alternative option to overcome the. Further, Malaysian Navy also converted a Merchant ship to a Naval Auxiliary Vessel in order to escort merchant vessels across the Gulf of Aden. Modifications included the addition of a hangar for helicopter landing, added cabins for crew accommodation and additional safety boats, such as a Rigid-Hull Inflatable Boat.

Further, from the discussions it was understood that at present, joint operations or training with Navy and Coast Guard is minimal due to the limitations of the above discussed helicopters in the SLAF inventory. However, it was also revealed that joint discussion or planning in strategic or operational level has not carried out so far to identify the capabilities and limitations and the exact air support requirements of the Navy and Coast Guard in Maritime Security.

DATA ANALYSIS

The gathered data were analyzed to find out the suitability of the existing helicopters to support for joint operations in countering identified maritime security threats to Sri Lanka.

From the radius of actions of the helicopters it shows that no existing helicopter other than the Mi 17 with 04 auxiliary tanks is capable to operate to the extreme edge of the EEZ even with auxiliary tanks and also not considering a loitering time over required location. The Mi-17 when fitted with 04 auxiliary tanks could reach the distance of EEZ but unable to carry troops on board other than the crew is a major limitation. However, the distance covered by the helicopters with 02 auxiliary tanks could be utilized effectively in joint operations with thorough planning and training for the execution of swift and limited operations.
The limited number of helicopters (military versions) is the major issue in deploying in large scale and more frequently for the operations. However, thorough planning and utilization for only for essential tasks needs to be practiced during the execution.

To counter the illegal fishing maritime surveillance, is one of the most important aspects. Surveillance of the seas could be done using the existing helicopter platforms of the SLAF. However, only Mi-24 Co-MPASS could be utilized for the operation in electronic surveillance domain and the other helicopters are to carry out visual observations. Further, the limited number of platforms available could be utilized in North Western sea area in support of Coast Guard where the maximum poaching is reported. Effective deterrence could be exploited utilizing Mi-24 Helicopters.

Anti-smuggling operations also need effective surveillance and special troops operations. The helicopters are capable of operating in the coastal belt between Mannar and Negambo. It is not possible to carry out surveillance throughout. The helicopters could be utilized for the task to some extent. However, Navy and Coast Guard need to play a larger role in this aspect. The helicopters could provide air cover for the troops to be embarked on operations to search clear the detected smuggling boats. Capability of employing Mi 17 Helicopters in Rig and Drop operations in North Western Sea needs to explore effectively. Inability of helicopters to carry boats capable of operating in high seas and troops for rapid deployments is a major limitation.

Countering Human Trafficking is also needs continues surveillance and effective intelligence. Carrying out surveillance all around the country is an impossible task. However, helicopters could provide air cover for the Naval or Coast Guard troops on missions to search and apprehend the boats/ ships on human trafficking. Further, in case of search and rescue the limited number of winching devices available with the helicopters may create difficulties for effective response depend on the number of personnel in distress and the location.

The maritime terrorism was countered by Sri Lankan forces effectively during the past and SLAF Mi 24 gunships provided much needed air support for the Navy fast attack crafts against the suicide boats.

Maritime piracy required the capability to operate in the deep seas. Inability to carry the helicopters on board naval ships limits the utilization of same in anti-piracy operations. However, the option of converting merchant vessels into a helicopter carrier needs attention. Piracy close to the shore could be dealt by utilizing helicopters especially Mi 24 for the air cover and utility helicopter to air lift special forces teams and to rappel them to the seized vessels.

The protection of offshore oil rigs needs different actions due to the wide range of threats involve in that. SLAF Helicopters could provide much needed air support in different ways as per the available data most of the future platforms will construct within the reach of existing helicopters. Surveillance, deterrence and airlift of Special Forces in emergency situations are some of the operations that helicopters could be effectively utilized.

However, there are some major limitations with the SLAF helicopter which are common to almost all operations discussed above. The unavailability of flotation gears on some helicopters, limited night and bad weather capability will limit the utilization of helicopters effectively in different operations. Further, unavailability of proper communication facilities with surface forces, established Command and Control center and Pilots' limited experience on these coordinated operations are major obstacles needs to overcome at present.

FINDINGS AND DISCUSSION

Due to the limitation on number of helicopters in the SLAF it is not viable to utilize them in wide range of operations simultaneously. Therefore, the intelligence plays a major part in all these operations to get credible information and then to utilize the helicopters in relevant tasks as required for swift and essential operations.

The ideal first step in conducting joint operations in future, with respect to maritime environment should be to form a committee including representatives from SL Army Special Forces/ Commandos, SL Navy, SLAF and SL Coast Guard. They are to go through the capabilities and limitations of the particular service and to study the threats to maritime security and actions which are discussed in the paper. Identification of the threats and required counter actions would focus to prepare Doctrines for the joint operations in operational and tactical levels. Intelligence on these threats is vital to deploy the assets on operations as and when required due to the scarcity of resources.

The next step is to establish a separate operations command in view of coordinating the whole scenario. The firsthand information received by the operations command needs to analyze and then it is decimated to the respective authorities for execution. It is needed to establish Joint Force Command for the tasks with Coast Guard to handle these types of operations. The JFC needs to be in big picture all the time and SLAF dedicated air reconnaissance/ surveillance aircraft could help in this aspect.

In a joint environment, the main task is divided into sub tasks and they are delegated to the respective agencies that have the expertise on the task with the coordination of other agencies capable of performing the same task.

As identified in the analysis SLAF Helicopters have some operational limitations due to unavailability of specialist equipment for dedicated maritime role in addition to the number of helicopter available for the deployment. However the experience in the past proves that these limitations could be overcome through proper training, dedication and professionalism of the man behind the machine. The deployment of helicopters in support of joint operations to protect the maritime resources of the country is a calculated risk that required proactive arrangements.

In case of countering Illegal Fishing Navy and the coast guard could be supported by Mi-24 helicopters fitted with guns as a deterrence measure when foreign vessels carry out illegal fishing in Sri Lankan waters. The Mi-24 helicopters could be employed to carry out low level maritime air patrol missions, if the situation cannot be contained by the Coast Guard or the Navy. However, strict Rules of Engagements (ROE) are to be issued for the Pilots. Further, to carry out these operations best suited flying profiles are to be selected by the Squadron. Effective communication and coordinated operations with Navy and Coast Guard needs elaborated planning and training before execution because at present the Pilots are not familiar with these kinds of operations. The surface operators need to understand the limitations of the air and call for the air support only as and when the real requirement arises for the same. However, maritime air patrols within the territorial waters could be carried out on selected days based on intelligence and selected areas.

For the Anti-Smuggling operations Bell 212/ Bell 412 or Mi-17 helicopters could be utilized for random visual surveillance flights over identified areas within the territorial waters. Further, based on the requirement projected by the Navy and Coast Guard, Mi-17 helicopters could be utilized for the Rig and Drop operations in North Western seas. Further, Mi-24 helicopters with auxiliary tanks and guns could provide air cover within the territorial water for surface force operations.

Maritime air patrols over frequent sea routes where the boats sail with illegal migrants, using Mi-24 and Mi-17s of extended range would be deterrence in minimizing human trafficking along the coastal belt and territorial waters of Sri Lanka. In addition to that these helicopters could be utilized to provide air cover for the search operations of Navy and Coast guard on apprehended boats within territorial waters. Further, Bell 212/ 412 equipped with the hoist could be utilized to rescue people from distressed vessels. The limitations of hoists in Mi-17 could be overcome by carrying out training on Stabilized Tactical Airborne Body Operations (STABO) involve of Special Operation Forces. Proper coordination and planning with Navy is vital to position naval vessels to receive rescuers in these operations.

The maritime terrorism also needs well-coordinated operations and thorough planning on utilization of Mi-24 in support of naval vessels considering the threat dimensions. Effective utilization of MI 24 CoMPASS in these operations would give additional advantage for the success of these operations.

The requirement of deep sea operation in Maritime piracy and inability to carry bigger boats on board helicopters

needs some improvised method to achieve the task. One of the best options available needs strategic level decision to convert a merchant vessel into a helicopter (probably a Bell 412 with floatation gears and winch) carrier using the technology available with the Colombo dockyard.
Further, in case of anti-piracy operations, Mi-17 could be used to deploy special operation troops in to seized vessels with the air cover provided by Mi-24within the territorial and some areas of the EEZ. However, it is required to acquire the capability to conduct fast roping operations utilizing Mi-17 helicopters to reduce the exposure time of helicopter and the troops to the pirates during the disembarkation.

In case of protection of future offshore oil rigs Mi-17 and Bell 212/ 412 could be utilized to provide the surveillance as required. Further Mi-24 is to carryout Combat Air Patrol in the area as a, deterrence measure. The Bell 412 and Mi-17 could be utilized to airlift of Special Forces and rescue troops in emergency situations.

All the operations discussed above need specialized training. Further it is more challenging for the pilots due to unavailability of much needed specialized equipment and limited capabilities of the helicopters. Pilots' lack of experience for these coordinated operations also needs to be addressed during the training. Therefore it is compulsory to include comprehensive theory, practical sessions and simulator based training.

Further, it is a mandatory requirement to upgrade the helicopters with specialized equipment for dedicated maritime operations. Overhauling of the helicopters presently unavailable for operations is also a vital requirement for simultaneous operations in different sectors. Redeployment of existing helicopters for the maritime role is to be done depend on the requirements of the Navy and Coast Guard. Further, proper communication facilities are to be provided for the coordination with surface forces during the operations.

CONCLUSION

As a military organization, SLAF intends to contribute the nation building by utilizing helicopters to combat illegal activities in the sea and protect maritime resources. SLAF could utilize present helicopter fleet for limited operations with proper planning and coordination with other sister services. However, it needs to upgrade the fleet for dedicated full spectrum maritime operations. Similarly, to be in line with the mission and the machine, pilots are also needed to be trained to match the task.

RECOMMENDATIONS

- Form a committee including representatives from Army, Navy, Air Force and Coast Guard to develop action plan to counter threats on maritime security.

- Establish Joint Force Command for Maritime security

- Utilize existing helicopters in limited joint operations considering the capabilities and limitations.

- Existing helicopters are to be redeployed in order to cater the joint operations.

- Acquiring sea based operations capability for helicopters through improvised methods due to financial constraints.

- Aircrews are to be given specialized training on maritime operations.

- The helicopters are to be upgraded with specialized equipment, auxiliary fuel tanks and carryout overhauling of helicopters to cater simultaneous operations in future.

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Maritime Surveillance and Strike

TRANSFORMATION IN ROLE OF UNMANNED AERIAL VEHICLES TO MEET THE MARITIME SECURITY CHALLENGES

By
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What is called "foreknowledge" cannot be elicited from spirits, nor from gods, nor by analogy with past events, nor from calculations. It must be obtained from men who know the enemy situation

—Sun Tzu

Abstract – Present day military challenges in Sri Lanka are mainly focused on maritime security of the country. As an island nation, important operational needs to be identified positively and unambiguously. In time, threats that originate in the maritime arena and prevent hostile and illegal activities are high in priority. Such activities may include illegal fishery, piracy, human trafficking, terrorist activities and any other activity aimed against the country's sovereignty. At present Sri Lanka Navy (SL Navy) and Sri Lanka Coast Guard Department (SLCG) are the main stakeholder of the maritime security context of the country. The service those organizations render towards the maritime security is appreciable but there is an operational gap can be identified in the present system due to various limitations and constrains.

Maritime surveillance requirements are demanding specific capabilities and performances such as mission endurance, flight profiles, mission equipment and human factors. UAV has unique characteristics such as range, endurance, less vulnerability of human and real time information gathering to overcome the operational gap of the present system. In this context the requirement of transformation of the role and task of the UAVs in SLAF is necessary to utilize UAV s for maritime security needs. New strategies and plans are to be formulated to meet these challenges. The paper mainly concerns on the operational gap of the present system and the possibilities of the overcome those challenges by utilization of UAVs.

This is a qualitative study. Method of data collection of the research consists of primary and secondary sources. Primary source includes the interviews of expertise of the relevant fields. Secondary sources consists publications, Manuals and web sites of relevant subjects. Gathered raw data further analyzed and presented, subsequently recommendations made in line with enhancing the maritime security capabilities through effective utilization of UAVs in maritime security domain.

Keywords — Maritime Surveillance / Unmanned Aerial Vehicle/ Maritime Security

INTRODUCTION

"Ensuring National Security through effective employment of Air Power"

—Vision of the Sri Lanka Air Force

As the vision of the SLAF illustrates, SLAF utilized UAVs vastly and effectively during the Humanitarian Operation and contributed significantly to the successful conclusion of the war. After the war, securing the maritime arena becomes highest priority in the present day national security objectives of the country. As the only force which capable of projecting air power; SLAF is obligatory to effective utilization of its resources to protect the sovereignty of the country and contributes to the Nation Building in present context.

SLAF has the tailor made solution to fulfill this current security objective of the country. UAV would be the most suitable machine to conduct maritime surveillance, as UAV possess the unique characteristics such as endurance, low radar cross section, real time information gathering, high resolution payloads, zero risk for pilots, deep penetration capabilities and less vulnerability.

The effective surveillance in the sea is a highly complex task. Several challenges of the present scenario can be identified such as vast operational area of the sea, limited resources and capabilities of the Coast Guard and the Navy, acquiring new technologies for detection and identification, and the use of the air and surface dimensions of the sea. In the future, Maritime Surveillance is expected to become increasingly complex, with greater importance being given to new and advanced technologies, as well as to the critical dimension of space.

The introduction of unmanned aircraft platforms will remove the limitations that have restricted manned missions, while introducing new capabilities that significantly enhance operational flexibility and efficiency of maritime control. This capability is specifically important, as country is required to cover growing maritime areas claimed by the Economical Exclusion Zones (EEZ) that span up to 200 nautical miles from coastline.

BACKGROUND

History of Integration of Air Power in Maritime Role

Long before the navies of the world had felt the need of using the airspace over the battle area to their advantage (Rajesh K 1997). The idea then was to raise the height of the eye and detect the enemy disposition early. The first attempt for air power application for maritime role had direct relationship with unmanned aerial vehicles as balloons came

first and were used by the navies for detection of enemy, search and rescue and in certain cases to inflict damage to the enemy ships (Rajesh K 1997).

What Is UAV?

U.S. Department of Defense Dictionary defines Unmanned Aerial Vehicles (UAVs) as "a powered, aerial vehicle that does not carry a human operator, uses aerodynamics forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expandable, and can carry a lethal or non-lethal payload" (Newcome, 2004). It is quite different from the man-controlled air vehicle because, under the unmanned condition, the flying process is automatically controlled by the electronic system. There is no necessity to fix any equipment inside the aircraft for the pilot, which can effectively save spaces for the control equipment of the machine.

The general perception of duties of UAV can be categorized in to the "Three Ds" as Dull, Dirty and Dangerous works. Often the mission combines two of these elements. In case of aerial data acquisition, the collection of data for industries like agriculture, construction, mining, and land or resource management are not an exciting endeavor. This "dull" mission is often carried out by helicopters, but when conditions shift or mechanical failure occurs, the use of a helicopter can prove "dangerous" for the human pilots aboard. Using an UAV for these types of missions is important to reduce risks on several fronts.

*W*hy UAV is Significant in Maritime Surveillance Role?

The technology on UAV has developed vastly and widely used in the field of military affairs and civil purposes. Due to the good flexibility, high efficiency, low cost and damage, low risk, and excellent monitoring ability and widespread coverage it can be applied in maritime surveillance such as maritime patrol, investigation and emergency response, maritime search and rescue, navigation, monitoring and inspection of the oil and sewage spills from ships at sea. Utilization of UAV can effectively

expand the uses of monitoring sea areas; reduce the phenomenon of illegal use of sea.

Significance of Location of Sri Lanka in the World Map and Importance of Maritime Security

Sri Lanka was known to the world through sea trade and the history was shaped over the years. The Indian Ocean which Sri Lanka is located has become the focal point of the 21st century. Economic globalization has further enhanced sea borne trade with 70% of global oil trade and 50 % of the container traffic passing through the Indian Ocean and the sea lanes have been identified as the "New Silk route".

Sri Lanka located in the southern tip of India, lies at the crossroad of all maritime routes in the region. It is an economically arising region mainly Figure 1 shipping lanes near Sri Lanka due to the rapid development of two giants India and China. Sri Lanka's location has given prominence in the strategic dynamics of the major powers, thereby making it a gateway to East Asia and doorstep to South and

South East Asia.

Figure 1: Shipping Lines of Indian ocean region

Today this sea rout is operational with averagely over 200 ships transit daily South of Dondra Head to the West and the East. 36000 ships are passing through southern port of Hambantota annually, including 4500 oil tanks. If these sea lines of communication (SLOS) disturbed the impact would have on the international maritime trade is unimaginable. Therefore Sri Lanka has to play a major role in protecting these vital SLOCs by ensuring the sea routes are safe and secure.

As an Island nation we have huge maritime area claimed by the EEZ extends to a distance of 200 nautical miles from the coastline (Lesly J).The area enclosed by the EEZ is reported as 517,000 sq. km. which is 7.8 times the total land area of the country(MFOR, 2002). Within this zone Sri Lanka has exclusive rights to explore, exploit, conserve and manage natural resources, both living and non-living, rights to authorize regulate and control scientific research. Therefore ensuring the security of EEZ takes significant potion in the national security context of the county.

Furthermore securing SLOC, maintaining sound SAR system and securing the county's EEZ have direct influence on the sustainability of the maritime related industries of the country which significantly contributes to the economy of the country.

Role of the SLAF UAV Squadrons

At present SLAF operates Israel made Searcher MK II UAV. UAV squadron has specific duties and responsibilities in SLAF. Following are the main war time applications of the UAV Squadron (AFOrder157,2009).

- Real time day and night reconnaissance – detection and recognition of target.
- Battlefield surveillance
- Target acquisition
- Artillery fire adjustment
- Battle field damage assessment
- Intelligence gathering

Peace Time Role of UAVs

UAVs are useful military hardware in the time of war but also UAVs can perform various jobs and civil application in peace time and post war period. SLAF also conducts some of the operations such as search operations on deforestation, cannabis cultivation, monitoring development projects. Following are the peace time applications of UAVs.

- Border reconnaissance.
- Sea surveillance.
- Search and Rescue operations.
- Traffic control.
- Disaster management purposes.
- Providing of weather information.
- Search operations on deforestation.
- Search operations on cannabis cultivation.
- Monitoring development projects.

Capabilities of SLAF UAVs

The general characteristics and capabilities and of the Searcher MK II system are mentioned below (IAI 2001).

Capacity	68 kg (150 lb) payload
Length	5.85 m (19 ft 2 in)
Wingspan	8.54 m (28 ft 0 in)
Height	1.25 m (4 ft 1 in)
Gross weight	500 kg (1,100 lb)
Power plant	Limbach L550, 35kW (47 hp) each

Table 1: General Characteristics of Searcher MK II

Maximum speed	200 km/h (125 mph)
Endurance	18 hours
Service ceiling	6,100 m (20,000 ft)

Table 2: Performance of Searcher MK II

Regulations and Policies for UAV

In Sri Lanka specific and local rules and regulations have not been formulated for UAV flying. But as per the International Civil Aviation Organization (ICAO) all the Rules of the Air apply to all aircraft, manned or unmanned. Furthermore, they oblige contracting States to maintain national regulations uniform with ICAO standards, to the greatest possible extent, and to prosecute all persons violating them (ICAO2011). This is the basis for international harmonization and interoperability, which is as essential for unmanned and manned operations to be conducted safely. The ICAO published a separate circulation for UAVs as ICAO Cir 328, Unmanned Aircraft Systems Order Number: CIR328/ ISBN 978-92-9231-751-5 (ICAO2011) under the approval of the Secretary General International Civil Aviation Organization.

STATEMENT OF THE PROBLEM

There is an operational gap in present day maritime surveillance operations due to some limitations of the present system. On other hand this can be identified as a gap between the present operational capabilities and operational requirement of the field of maritime surveillance. Perhaps this may interpret as the weakness of the present system.

The prospect of utilizing UAV for maritime surveillance is not new to other countries in the region. But Sri Lankan maritime surveillance and SAR systems only rely on the traditional methods such as observation by Naval vessels, Radars and boats. Can UAV fill this operational gap of the present system? This paper will answer this question with comprehensive study on potential values of UAV in maritime surveillance application.

RESEARCH HYPOTHESES

The Integration of UAVs to the Maritime Surveillance operations will reduce weaknesses of present maritime surveillance operations and enhance the effectiveness of airpower application to the present day maritime security objectives in the country.

METHODOLOGY

This is a qualitative study. The study has followed descriptive research based on survey method. Following actions have been taken in the research process.

- Identifying the present Maritime Surveillance system in Sri Lanka.
- Conduct literature survey on UAVs, maritime surveillance and application UAV in maritime surveillance.

- Conducted interviews with expertise of the field to get the information on application of UAVs for maritime surveillance and problems related to the subject.
- Analysis on the gathered information.
- Make recommendations based on the findings.

RESEARCH OBJECTIVES

The four objective of the thesis are

- Study about the present maritime surveillance system of Sri Lanka.
- Identify the issues (operational gap) of the present Maritime Surveillance system (If any).
- Investigation on potential values of UAV in maritime security operations which capable to overcome the operational gap.
- Make recommendations to address the issue.

SCOPE AND LIMITATIONS OF THE STUDY

The paper focuses only on available UAVs in SLAF.

Due to the limited resources available, conducting maritime surveillance around the Island is beyond the capability of the SLAF. Therefore this research scope limited to formulate a model which applicable for anywhere where the required facilities are available.

Validation of the recommendations cannot be measured since recommendations are applied in real scenario before.

ASSUMPTION

The paper is based on the assumption of the prevailing UAV system, that (Searcher MK II) in SLAF will be fully serviceable and exists for future maritime operations and all recommendations made based on this assumption.

DATA COLLECTION

The data required for the study were gathered from the following sources.

- Interviews with experts in respective fields
- Manuals and publications of
- Searcher MK II system
- Web sites related to the subjects
- Journals
- Articles
- Previous researches

FINDINGS

Gap of the Maritime Surveillance Operations and, How Does UAV Fill This Gap?

As emphasized in the problem statement a gap can be identified in present day maritime surveillance operation due to some limitations of the present system. On other hand this can be identified as a gap between the available operational capabilities and existing operational requirement of the field of maritime surveillance. This may interpret as the weakness of the present system. Under the above sub topic the author comprehensively describes the limitations and difficulties that can be identified as the main reasons for the operational gap. Further explains the possibility of overcome these difficulties by capabilities of UAV.

Detection and Identification: Detection and identification are the main difficulties of MS as well as SAR missions in Sri Lanka. Detecting a target in the sea is a difficult task. Regular offshore and inshore patrols are the main sources of detection and identification in the sea. If the target is moving identification is much more difficult. Most of the instance SAR missions carried out with the assistance of merchant ships to locate the targets. Dedicated maritime surveillance aircraft may do the job well but in Sri Lankan scenario our assets are not capable to match the requirement. Beechcraft is the only aircraft equipped with the camera to this task but common limitations of manned aircraft are applicable to Beechcraft too, hence the advantage of UAV on detection and identification is comparatively high than other machines in the field.

UAV would be the most suitable application to overcome this constrains. UAV gets to the scene immediately and fly above the object area with slow speed. The UAV can detect the live objects with the airborne visible light and infrared pod. The infrared sensor of the electro-optical pod can separate the color of the live objective with the unlived within the field of view.

Observation scope is very less in the ship, boat and manned aircraft as only you can see visually or added with any equipment unless operates in a dedicated maritime surveillance aircraft. Maritime Radar systems have some weaknesses as they can cover up to the territorial waters of the Island due to the limited range.

The main advantage of UAV in this factor is 360 degrees of aerial view which can be obtained by UAV payload; it can give full picture of the situation at any time. The area of observing of the UAV is much broader than a ship or a boat.

Speed: There is an obvious trend that the ship become more and more large and fast, the high-speed vessel and large container ship have got a speed of 28 knots (Gui-Jin 2014). Unfortunately, most of the patrol craft in maritime system has some limitations to reach this level. UAVs can effectively supplement the shortage of the patrol craft in speed and efficiency. With the introduction of the UAV, it can provide quick-response and timely-investigation to

prevent the hit-and-run of the vessel. It can also record and store the evidence with the use of on-board camera devices for further handling.

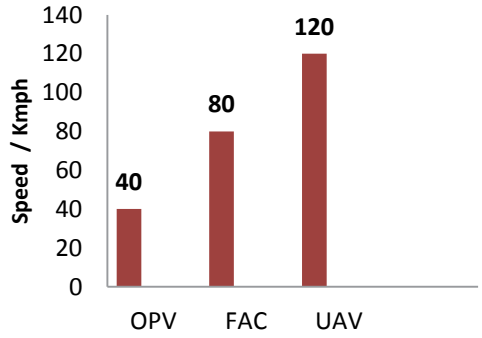

Figure 2: Analyses of OPV / FAC and UAV

The speed of the some manned aircraft is inherently higher than UAV but only advantage of speed of the manned aircraft cannot compete with the UAV capabilities. The below mentioned figure is an analysis of the speeds of SL Navy assets Vs UAV.

Surprise: Vessel surveillance cannot maintain the surprise due to some limitations which has in the ships. Main reason is the ship like to be visible to any human even to naked eye or added with equipment. Hence Naval vessels and boats face difficulties when conducting surveillance and reconnaissance missions as it is difficult to maintain the surprise. Helicopters and fixed wing aircraft have to fly low level to locate the target, which obviously loss the surprise. But UAV can operate from 10000 to 20000 fts and get the clear picture of the situation which enables to conduct the operation without losing the surprise.

Vulnerability: Less vulnerability is great advantage of the UAV. Any manned aircraft, OPV, FAC or boat is vulnerable as it needs be controlled by onboard crew. Any emergency situations in the sea, the damage and the disaster are high as crew is onboard. Comparing UAV with OPV / FAC/ Coastal Surveillance Craft or manned aircraft, UAV is the less vulnerable as it does not carry human. UAV can undertake any job which manned machine cannot perform due to less vulnerability of the aircraft in air.

Cost: Maintaining and operating a fleet of vessels and dedicated maritime surveillance aircraft is costly. The mechanical systems and other maintenance are costly and initial procurement and installations are expensive.

Operational cost of manned aircraft, OPVs and FACs is also high. Perhaps the initial cost of the installation of UAV system may costly but this will be a good investment when comparing the operational cost of the other machines. As an example it just costs approximately Rs 7816.83 to fly hour of Searcher MK II (111SQN2014). The cost of Beechcraft hour is Rs 136686.18 (8SQN2014).This indicates the cost benefit of utilizing UAV in long term.

Operational Flexibility: As a common weakness of manned aircraft compering to the UAVs,the area of operation can be limited due to some limitations such as vulnerability, less endurance which limit the operational flexibility. All the limitations of the vessels ultimately lead to reduce the operational flexibility. But UAV can be applied to every aspect of Maritime Surveillance even offshore, inshore, coastal surveillance within the radius of action. UAV can be switched rapidly between widely separated and diverse targets.

Unmanned vehicles, as a consequence of being unmanned, are not impeded by the limitations that might be imposed on manned systems during sensitive operations where the vehicle could be lost. These characteristics provide additional operational flexibility to the commander that may not exist with manned platforms. The lack of threat to aircrew members (i.e., the avoidance of potential killed in action [KIA], missing in action [MIA], and prisoner of war [POW] situations), even the vehicle might be lost over "unfriendly" territory, it offers flexibility to conduct missions where unduly risky for manned aircraft.

Weather limitations: Weather constrains are common difficulty of maritime operations. Wind and rough sea are frequent distractions of the maritime surveillance. Some instance you can find bad weather condition in the sea surface which restricts the naval operations, but UAV can avoid the bad weather by flying above the cloud base and can reach the dangerous area that most people and craft cannot get in. If the UAV is equipped with, it can fly above the cloud base to avoid the weather and Synthetic Aperture Radar can penetrate the cloud base and get the clear pictures.

Situational Awareness: Situational awareness is an essential factor not only in maritime security but also in other military operations. All the limitations that I discussed early, ultimately lead to a situation where short of updated information.

In present maritime surveillance operations only the crew of the particular ship, boat or radar station can observe the condition of the situation. It has to be conveyed to the relevant authorities. This procedure takes time and authentication is needed to the information passed, but UAVs can do this job with providing quickest and latest updates of the situations. UAV can distribute its real time video images to the desired locations which immensely contribute to increase the situational awareness.

During the Humanitarian Operation real time video images have been distributed to the field commanders of the battle field. The same system can be adapted to the Maritime Surveillance context also. Real time image down link can be provided to the all Command and Control Centers of the Maritime Security / Search and Rescue operations.

Developments Need

Updating the System: SLAF acquired Searcher MK II UAV system in 2009 and utilized excessively in Humanitarian Operation. Un serviceability can be expected in future due to the excessive and prolong usage. Therefore the available Searcher MK II system needs to be upgraded to advance Searcher MK III system in order to meet the requirement of maritime surveillance.

The other option is to purchase a new system which can meet the operational requirements of the maritime surveillance.

Centralized Command and Control and Maritime Air Organization: Since maritime air assets for small states like Sri Lanka would be limited in numbers, the command and control of these vital assets would be prime importance. In order to achieve effective command and control, a Maritime Air Organization (MAO) would be required. A well-organized MAO would result in less lead time between the detection of a threat and for further actions.

Since UAVs are available with SLAF and control of the sea done by SL Navy proper integration and cooperation is highly required in the operation scenario. Therefore Joint Force Command (JFC) is also required to strength the synergy of the forces and joint warfare development. Functional responsibility of JFC is ISTAR and C4, therefore new JFC have a role in maritime surveillance. The diagram of the proposed MAO is shown below.

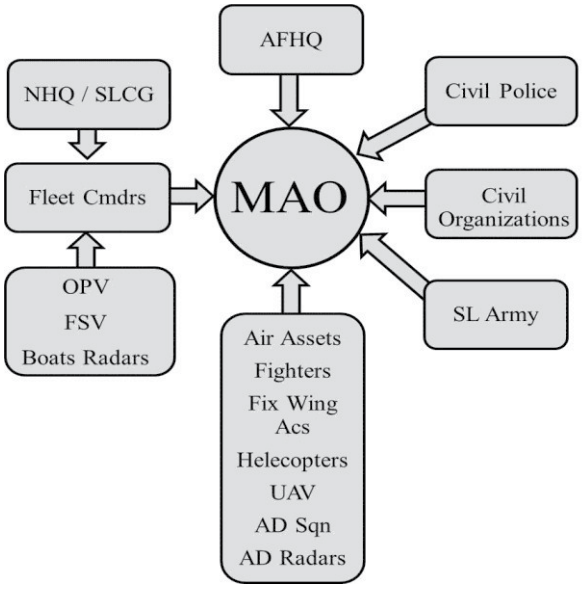

Figure 3 : Model Structure of Maritime Air Organization

Joint Training*:* Since UAV application to maritime surveillance is new concept joint training with SL Navy and Coast Guard for the UAV pilots and crew is important fact before deploying UAVs for Maritime Surveillance. Furthermore training with friendly countries which are maintaining sound maritime surveillance system integrated with UAVs will enhance the professional knowledge of the UAV pilots and crew when SLAF is integrating UAVs for maritime surveillance.

Research and Development: The ongoing UAV R&D project in SLAF shows quite a well improvement recently. The project was initiated with the experts of the University of Moratuwa. Recently the project has developed an air frame and data link which capable to fly 10 km from the GCS. Presently they are developing the data link for further range enhancement. But it may take time to develop an indigenous UAV which capable to conduct Maritime Surveillance operations. Therefore necessary actions are to be taken to continue the process. Technical collaboration of same projects in friendly countries in the region may helpful to develop our project. The best example is India. India was able to developed their owe UAV named "Nisnath" recently.

Doctrine: A doctrinal working group may be set up to formulate a maritime air doctrine, which will allow effective employment of the airpower with available assets. It is important of having a tactical doctrine for maritime surveillance as experience and lessons learnt in the past could be recorded for the future applications when necessary. During the Humanitarian Operation the synergetic effort of the three forces in every action was exhibited well. Those experiences will be vital when formulating strategies for warfare of next generation. Hence developing a doctrine not only for maritime air operations but also for other operations is vital to face future security challenges of the nation.

Enhancement of the Range: To this constrain there is only two options, either to develop the available system in the location where close to the sea or acquire a new UAV which uses satellite technology which capable of long range patrolling. L band SATCOM seems to be the preferred route for safety of flight in UAVs. F.A.A. also sets steps on the L band and Ku band SATCOM approach for UAV operations (INM2013).

Present deployment of UAV Sqn is not very close to coastal belt. If available UAV deploys for maritime surveillance, UAV Sqn to be expanded to deploy at the airfields situated close to the coast. To maximize the range of the UAV, either it should deploy in the air field close to the coastal or deploy Advance Launch & Recovery Station (ALRS) at a location where close proximity to the sea or OPV anchored in the sea.

Transformation of role and task of the UAV Sqn*:* Considering all the facts gathered and analyzed, it is necessary to reevaluate and transform the present task and role of the Sqn in line with the present maritime surveillance requirements. This may execute by facilitating, training and task orientation and updating existing system in order to enhance the airpower contribution to fulfill the maritime security needs of the country.

But to operate in several locations requires more assets. The financial constraints and high cost of these sophisticated equipment, remains as a main barrier for development of maritime surveillance system.

VERIFICATION OF HYPOTHESES

Considering the all above analysis it is clearly indicated that the hypotheses of the paper is proved as the Integration of UAVs to the Maritime Surveillance operations will reduce weaknesses of present maritime surveillance operations and enhance the effectiveness of airpower application to the present day maritime security objectives in the country.

RECOMMENDATIONS

- Enhance the range of the available UAV system of the SLAF by relocating AGCS or ALRS.
- All unserviceability of the present system to be rectified to deploy them for maritime surveillance.
- Proper administration of maritime surveillance. Sectoring the maritime area and tasking UAVs for surveillance at respective areas.
- Establish centralized organization for administration, coordination and monitoring of maritime air operations.
- Formulate a Joint Force Command (JFC).
- Continuation of the present R&D project and collaboration with experts of the technology.
- Technical collaboration with countries that are being in sound UAV R&D projects.
- Formulating doctrine for maritime security operation in SLAF.
- Either acquire a new system or upgrade the available UAV system in order to deploy them for maritime security operations in future.
- Conducting joint maritime excises with Navy and Coast Guard and get the assistance and training from the countries who maintain sound maritime surveillance system integrated with UAVs.

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IMPORTANCE OF FORMULATING A FIGHTER SQUADRON WITH MARITIME STRIKE CAPABILITY FOR SRI LANKA AIR FORCE

By
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WWV, RWP I, RSP, Pg.Dip(Def Stu) in Mgt, qfi
and
Flight Lieutenant HMTK Herath

Abstract — Indo pacific region comprises the world's busiest and strategic chokepoints for marine trade and energy transportation. Due to geopolitical importance and being an island nation, maritime security plays a vital role in political, economic and social aspects of Sri Lanka. Yet the focus on maritime security and co-ordination mechanism between Sri Lanka Air Force and Sri Lanka Navy is not significant. This dissertation examines the Importance of formulating a fighter squadron with maritime strike capability for Sri Lanka Air Force. By examining this researcher identify the importance of enhancing maritime strike capability in line with the nation building process.

Researcher used the qualitative method for this research work. In that researcher referred to open source literature available on World Wide Web with regard to maritime security and threats, regional defence forces who operates in Indo Pacific region and the capabilities of regional defence forces. Further researcher gathered information with regard to affiliation of maritime security with the nation building process.

With that information analysis researcher elucidate the Importance of formulating a fighter squadron with maritime strike capability to ensure the security of the territorial waters and Exclusive Economic Zone. Further, intend to highlight the importance of synchronisation with the other defence forces in the region to ensure the security of Sea Line of Communication. This increment of maritime strike capability and security will indirectly boost the economic progression of the country.

Keywords: Maritime security, Maritime strike squadron.

INTRODUCTION

Sri Lanka is an island nation in the Indian Ocean possesses coast line of 1340km. It includes territorial waters expands up to 12nm and Exclusive Economic Zone up to 200nm from the base line. In ancient history Sri Lanka emerged as a crucial trading hub and it was well known as "Pearl of the Indian Ocean". It was extensively used in china's maritime string of pearls concept and again in World War II as military naval and aviation hub in Asian region. Sri Lanka possesses several important natural deep sea harbours in strategic locations such as Trincomalee, Mannar and Galle.
Conforming the Geopolitical significance again and again Sri Lanka was invaded or occupied by foreign entities throughout the history. Sena and Guththika" from south India were the first invaders at the period of King Suratissa. Though the country was invaded by Indian invaders numerous times afterwards no counter measures were taken by any King or Queen to protect the shoreline or the natural harbours.

In present context Sri Lanka is on a rapid economic development path. At the same time power play in Indian Ocean region by worlds super powers growing by the day. Situation has further arose when china announced their modern maritime silk route and their military presence in the Indian Ocean region. Other key players such as India, United States of America, United Kingdom, Australia, Singapore and Japan have tighten their military readiness to have favourable situation in the region. They conduct joint military conferences, combined training sessions and joint military exercise within and out of the region. By merging with those who operates in the region will definitely boost the strength of Sri Lankan armed forces. Considering about the Sri Lanka Air Force the fighter pilots have proven their skill and ability in Air interdiction. They have successfully carried out operations in day and night to the ground targets as well as maritime targets in highly vulnerable air situation. In post war scenario the same capability can be utilized to gain maritime dominance in the region by taking part in the common maritime security strategy for the region. In order to merge with the common maritime security strategy Sri Lanka should possess strong foundation in maritime security. Researcher suggest to fill that with fighter squadron with maritime strike capability

STATEMENT OF THE PROBLEM

Whenever an island nation fails to protect and enforce law over the coastline and territorial waters effectively, that nation have been invaded by the foreign soldier of fortune and invaders. Sri Lanka was invaded repeatedly by intruders throughout the history of Sri Lanka. Most of the calamities happened in the country have been emanated through coastline and they have shaped the history of the country full of darkness and terror. The remains of darkness still reflects in the country's culture and social behaviours. Yet rulers of Sri Lanka have not paid attention to secure the coastline and the natural harbours all around the Sri Lanka.

As of now the Geopolitical, geo-economical concern of worlds super powers focusing to the Indian Ocean region to fulfil their national interests. In order to competitively stand with those super powers Sri Lanka too should have to have political and military strength other than the geopolitical significance. At present Sri Lanka is on a rapid economic growth with global hub concept. Colombo harbour, and Hambantota harbour have become busy in recent past. They will boom with work when the infrastructure further develops. At the same time when economy of country is growing, the security concerns too should increase. Yet the security related awareness of general public as well as political leadership is not sufficient. Thus researcher endeavours to emphasise the importance of increase of maritime strike capability through a new maritime strike squadron.

METHODOLOGY

Secondary data was gathered through the World Wide Web with regard to maritime security, threats, and other Armed forces who operates in the region and their capabilities. Further, the researcher gathered information with regard to affiliation of maritime security with the nation building process. Conceptual and empirical research documents available with regard to research work also reviewed during the data collection. Researcher concentrated and focused the research work to the current requirement of Sri Lankan context which is on developing state. Since the subject is sensitive to security, information freely available are limited. Thus researcher interviewed few professionals involve in the national security.

Since the research work is limited to Indian Ocean region writer studied about the maritime security involvement of India, United States of America, China and Singapore. Study was narrowed down further to maritime Strike through fighter jets which can operate from land based platform. It was assumed that Sri Lanka is not in a position to acquire and maintain an Aircraft carrier or Submarine. At the end of the study researcher attempts to derive a feasible solution to enhance the maritime strike capability with available and acquirable resources.

COLLECTION OF DATA

Geopolitical Situation in Indian Ocean

The geopolitical analysts have viewed the configuration of earth on the bases of arrangement of lands and waters and interconnecting lines of these two phenomena. Most of the geopolitical concepts date back to more than hundred years ago and analysed the reciprocal relations between men and the state and natural environment. Indian Ocean over the time has become one of the most important Oceans of the world with respect to the growing economic activity of this globalized world.

It is the third largest Ocean of the world being neighboured to Asia in its north, Africa to its west, Indo China to its east while Antarctica lies in its south. It ranges from north to south from the Bay of Bengal to Antarctica with estimated area of 9600 kilo meters, while it extends from west to east from Southern Africa to Western Australia with the range of 7800 kilo meters. Indian Ocean covers almost 20 per cent of the world's water. Its total area is about 68.556 million square kilo meters. The ocean total area includes Andaman Sea, Arabian Sea, Bay of Bengal, Flores Sea, Great Australian Bight, Gulf of Aden, Gulf of Oman, Java Sea, Mozambique Channel, Persian Gulf, Red Sea, Savu Sea, Strait of Malacca, Timor Sea, and other tributary water bodies. It also has several small island nations such as Sri Lanka, The Seychelles, Reunion Island, Maldives, Mauritius and the Madagascar, while a cluster of islands forming Indonesia borders the ocean in east.

It has remained an important area throughout the realms of history due to its unique strategic location and bulk of natural resources. However, in recent periods more with the spread of globalization the significance of Indian Ocean both politically as well as economically has been rapidly increased.

Strategic chokepoints for marine trade and energy transportation in Indian Ocean are as follows and same has been marked in the map given as Figure 1.

Figure 1: Sea Lines of Communication in Indian Ocean http://www.tamilnation.co/images/intframe/indian_ocean/indian_ocean_sea_lanes.gif

- Strait of Hormuz
- Strait of Malacca
- Bab-el-Mandeb
- The Sunda and Lombok straits
- Mozambique Channel

Sri Lanka – The Focal Point in the Indian Ocean

As clearly evident in the map in Figure 1, the world's busiest international shipping lanes or the Sea Lines Of Communications (SLOC's) pass through the Southern coast of Sri Lanka just 5 nm from land and this geographical position has made ample opportunities and potentialities.

Sri Lankan government introduced Global Hub concept as a grand strategy focuses on developing the Sri Lankan economy to higher standard. The concept of a global hub is based on strategically important five key areas. In aforesaid concept Sri Lanka is going to perform as Naval and maritime hub, Aviation hub, Commerce hub, Energy hub and Knowledge hub in the region. In selecting the key areas in which Sri Lanka is due to perform as a global hub, much of the weight have been given to the ancient glory of the island as well as the geographical positioning of the island on the world map.
As naval hub Sri Lanka would grow as a naval centre point within next 10 years providing a naval service centre for ships navigating past our seas, as estimated to be 200 vessels daily. There was much emphasis placed on the Hambantota Port which could provide facilities to attract over 10,000

vessels annually, compared to about 4,000 vessels arriving at Colombo Port. The focus was also on developing the South Colombo Port, Galle Tourism Port and, other ports such as the Trincomalee, Oluvil and Kankasanthurai.

Sri Lanka was chosen by the British Empire during the World War II as a naval and aviation headquarters, by recognizing its strategic positioning on the path of most air and naval routes. The government has embarked on infrastructure projects to build the second International Airport in the South, to modernize Katunayake International Airport and, to upgrade 14 domestic airports across the country along with emphasis on a developed road network connecting them.

As a Commercial hub, it focuses the activities such as Colombo Stock Exchange operations, foreign investment and, foreign banking in the field of commerce and to upgrade infrastructure and human resources in creating a commercial hub.

Rise as an energy hub within the next decade, the main focus of the government has been on oil exploration in satisfying the domestic energy demand and in entering into international oil trade.To make the country as a Knowledge hub in the region government focus to reversing the brain drain by creating environment to attract the expatriates for the benefit of the national economy and to reform the education system. The aim of the reform process is to create knowledge in line with the requirements of Sri Lanka as a dynamic global hub in key areas and to make the country a key hub for knowledge and learning in the world.

Becoming Naval and Maritime Hub

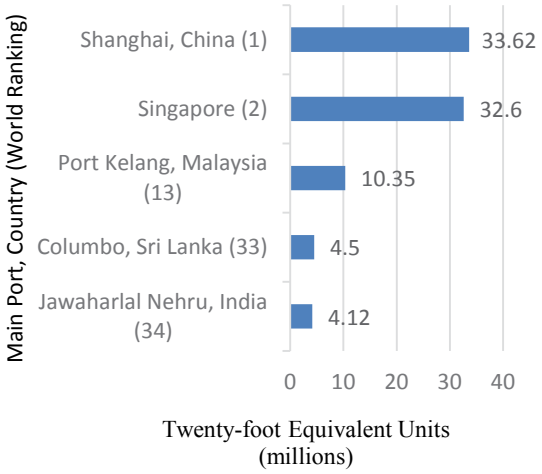

Figure 2: Container traffic in selected ports in Asia 2013 (http://www.worldshipping.org/about-the-industry/global-trade/top-50-world-container-ports)

According to the volume of the container traffic in terms of Twenty-foot Equivalent Units (TEUs) estimated by World Shipping Council, the first 4 busiest ports in the world are located in Asia: Shanghai, Singapore, Shenzhen and Hong Kong. Colombo Port in Sri Lanka ranked as the 33th among top 50 ports around the world does not seem to be too far from being a shipping hub in the region. Even under repressed political conditions in the island, Colombo Port has handled 4.26 million TEUs in 2012 and 4.31 million TEUs in 2013.

Sri Lanka is located in relatively advantageous geographical position to attract ships with the possibilities to have few international ports around the island, compared to many other countries in the region Sri Lanka has the potential to emerge as shipping hub for international trade, passenger cruise, ship building and repairs, bunkering, anchorage and other.

The Mahinda Rajapakse Port in Hambanthota which is deep sea port in the South, located approximately 12 km from the shipping lane will be a key service centre and Industrial port where large ships crossing could refuel. The port at Galle will also be developed as a yacht harbour and a tourist destination. Trincomalee one of the best natural harbours in the world will have a special economic zone, water sports and will be an industrial port. Therefore it is obvious that Sri Lanka is on rapid up growth to achieve the status of a maritime hub.

Conceivable Maritime Challenges and Threats in the Indian Ocean Region.

The Indian Ocean is a common theatre where the great naval powers seek to extend their power projection for their national interests. India is the foremost naval power in the region. The USA also has highly significant naval presence in the region. At the same time, the influence of China in the region is also expanding rapidly with its military modernization. China's increasing naval presence in blue waters and its expanding economic influence in countries of the region. It is obvious that the safety and stability of the Indian Ocean is critical for China's maritime trade security.

Maritime Terrorism is a great challenge in the region. During the three decades of terrorism suffered by Sri Lanka, the Liberation Tigers of Tamil Eelam, smuggled a vast arsenal of weaponry into Sri Lanka through the sea. Weaponry were stored in large floating warehouses off shores. Smaller vessels were used to ferry these items from those floating warehouses to desired locations. There is a greater connectivity between terrorist groups operating across the Middle East, Central Asia, South Asia and South East Asia. The mechanism used by LTTE can easily be replicated by any terrorist group or non-state actors who have desire on a nation's sovereignty and security.

Even though there is no any reported piracy actions in Sri Lankan waters there were number of incidents in Indian Ocean. At the moment there is no direct impact on Sri Lanka but it affects the entire maritime trade. Thus Sri Lanka also can be affected by piracy at any moment. Incidents of piracy have been dropped remarkably due to various reasons. Most of the ships keep On Board Security Teams to face piracy situations.

Drug trafficking has become the most challenging to control in maritime security. After the war Sri Lanka is rapidly becoming a transit points for drugs for the East and west as well. Heroin is routed via Sri Lanka from Pakistan or India on a big scale by sea in containers and mechanized fishing craft.

The trafficking of people is another grave issue that affects nations through the sea. Every year, thousands of illegal immigrants are transported through international waters to other countries. Most recent issue is multi day trawlers who illegally transferred to Australia.

Illegal, unreported and unregulated fishing also known as IUU fishing also bigger problem. IUU includes all fishing that breaks fisheries laws and regulations such as fishing without a license, fishing in a closed area, fishing with prohibited gear, fishing over a quota, or the fishing of prohibited species are a few of them. Sri Lanka faces the challenge of IUU fishing in its Exclusive Economic zone and many initiatives have been taken by the governments concerned to prevent foreign trawlers from encroaching in to our waters which is a life line issue for the local fishermen.

Sri Lankan sea is highly vulnerable to an oil spill risk, as 25% of the world's oil transportation, which runs up to a quantity of 550 million tons per annum, passes via Sri Lanka's exclusive economic zone. The risk will increase further with the proposed maritime based development projects in the country and also already functioning utilities.

Other Defence Forces In The Indian Ocean Region

Indian Naval Air Arm is a component of Indian Navy which task to provide an aircraft carrier based strike capability, Air defence, maritime reconnaissance and anti-submarine warfare. Goa which located in the western region of India is the base for Indian Naval Air Arm. INS Viraat and INS Vikramaditya are the Air craft carriers owned by the Indian Naval Air Arm. Sea Harrier jets that operate from the aircraft carriers act as Attack aircraft while MiG-29Ks plays the role as fighter interceptor. Tupolev Tu-142 which is a strategic bomber used by Indian Naval Air Arm for maritime reconnaissance and anti-submarine warfare. Boeing P-8 Poseidon is task to carry out maritime patrol and reconnaissance operations. Indian Naval Arm also uses Helicopters such as Kamov-31 for airborne early warning, Sea Kingand Ka-28 for the anti-submarine role. They UAV consists of the IAI Heron and Searcher-IIs which operates from both surface ships and shore establishments for surveillance missions.

Strongest power player in the Indian Ocean region is United States of America who operates from the island call Diego Garcia. Both Air Force and Naval units have been established in this facility. The base is known as Navel Support facility Diego Garcia. The United States Air Forces's 36th Wing, 715th Air Mobility Command, 22nd Space Operations Squadron, 18th Space Surveillance squadron are being positioned at Diego Garcia. Diego Garcia provides services for the vessels of the US Navy, British, MSC and Allied forces transiting through Diego Garcia. Even Indian Navy has the affiliation with said naval base and conduct joint military exercise named "Exercise Malabar" from 2007 to present. Since most of the military capabilities are censored this exercise can be taken as showcase of their capabilities.

"Exercise Malabar" is naval exercise involving the United States and India. In some years Participation has been expanded an involved Japan, Australia and Singapore. Malabar exercise series was began in 1992, and includes diverse activities, ranging from fighter combat operations from aircraft carriers, through Maritime Interdiction Operations Exercises. Last Malabar Exercise was held on 24th July 2014 at Sasebo Naval Base, Japan. The exercise will involve Carrier strike group operations, Maritime patrol and Reconnaissance operations, Anti-piracy operations and Visit, board, search, and seizure (VBSS) operations, Search and rescue exercises, helicopter cross-deck landings, underway replenishment, gunnery and anti-submarine warfare exercises, and Liaison officer exchange and embarkation. The Indian Navy partake the exercise with INS Ranvijay (guided missile destroyer), INS Shivalik (stealth frigate) and INS Shakti (fleet tanker) while Japan partakew with Two destroyers along with a P3C Orion and a Shin Maywa US-2. US Navy partake the exercise with one submarine, two destroyers, and one tanker along with one Maritime Reconnaissance aircraft are participating. One U.S. Navy Carrier Strike group based on the Nimitz class carrier USS George Washington is likely to join for the sea phase of the exercise.

DATA ANALYSIS

It is clearly evident that Sri Lanka is sitting on full of resources which can use make the country a better place. It's due to geopolitical significant location as well as natural resources available in and around the country. If considering the location first, Sri Lanka is located generally at the centre of the Indian Ocean region and as an Island. Not sharing the land border with any other country is a decisive factor to have a political stability. At the same time , the world's busiest international shipping lanes or the Sea Lines Of Communications (SLOC's) pass through the Southern coast of Sri Lanka just 5 nm from land. It is unexploited package by Sri Lankans yet. This geographical position can make ample opportunities and potentialities to boost the economy of the country. If we can assure the security within the area close by shore and waiting area for the Sri Lankan ports automatically the shipping trades will attract to ports. Since Sri Lankan government has defeated terrorism and no major piracy threat is in the close vicinity, ensuring the security is an achievable task. To achieve this task having a Maritime strike capability is essential.

It is obvious that the present global economy has been focused towards Asian region. Particularly the rapid

growing economy of china is a challenge to the western super powers. This rapid growing economy of china is highly dependent on Maritime trade and supplies through the Indian Ocean as clearly mentioned in data collection. That's why the China gives such prominence to modern maritime silk route project. Ports built by china recently such as Gwadar port in Pakistan, Port of Hambantota in Sri Lanka are the strategic stops in modern maritime silk route. Docking chines submarines in these ports have created some hostility to the regional powers. This power play around the Sri Lanka can be manipulated to get benefits out of it while keeping the Non-Aligned Foreign Policy.

Since Sri Lankan government was able to end the terrorist's activities around the sea, this area has become one of the safest sea area when considering to the other ports in the region. Ocean area in close proximity to Sri Lanka is free of terrorist activities and piracy activities with the end of war. The threats that country possess are drug trafficking, human trafficking, Illegal-unreported-unregulated fishing, oil spill and unauthorized oil or garbage dumping. In order to overcome above mentioned threats, deterrence is the tool. Powerful maritime strike force can use to control the threats.

FINDINGS

- Formulating a maritime strike squadron will not give direct pecuniary gain in return. Further the effect of enhancing security will not reflect in economic growth in short period of time.

- Strengthening the strike capability will gain the trust of shipping agencies, maritime insurance agencies and the country will have the competitive advantage over other regional ports for shipping trades.

- Enhanced security and law enforcement in the territorial waters will make the country, a big wheel in maritime trade and industry in the region.

- Formulating a new Maritime strike squadron is significant in order to have the deterrence over terrorist groups, Piracy groups, Drug smugglers, Arms smugglers and etc.

- When formulating a Maritime strike squadron it is important to assign role and task for this squadron. Roles and task of the squadron are;

    - To carry out air strike against maritime targets such as hostile ships, vessels, submarines in necessity.
    - To maintain close communication with Sri Lanka Navy in order to carry out effective combined operations.
    - To carryout combined exercise with Sri Lanka Navy such as combined strike against ship or vessel.
    - To actively take part in regional maritime security strategy practiced in the region.
    - To participate joint maritime exercise such as "Exercise Malabar".
    - To maintain and escalate the skill and proficiency level of pilots to highest standard.

- It is possible to formulate a fighter squadron with Kfir and F-7 till we acquire a new fighter. Out of these two options Kfir is more suitable with its strike capability.
- Further, in depth feasibility study should be carried out to decide the suitable location to place the squadron out of Katunayake and Mattala.

RECOMMENDATIONS

As clearly proved during the study formulating a fighter squadron with maritime strike capability in present Sri Lankan context in order to boost the economic growth of the country.

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Maritime Search and Rescue

IMPACT ON NATION BUILDING THROUGH MARITIME SECURITY INTEGRATED WITH EFFECTIVE SEARCH AND RESCUE (SAR) OPERATIONS OF SRI LANKA AIR FORCE: POST WAR CONTEXT

By

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Abstract - Foremost it's vital and also bit formidable to understand the relationship between nation building process of Sri Lanka and the maritime security which is closely integrated with Search and rescue operations of Sri Lanka Air Force. It is essential to understand the importance of having effective search and rescue capability as a part of Maritime security. The author throughout the academic work will try to highlight the relationship between search and rescue operations, maritime security and nation building process of an Island nation such as Sri Lanka in post conflict context.

The paper will focus on emphasizing the importance of having three dimension look from the air in terms of SAR in addition to presently available resources and agencies such as coast guards of Sri Lanka Navy, to address the future demands on its way to the nation building process. In these aspects the author will carry out in detail analysis over a broad spectrum of areas taking in to consideration the rising requirements of present day in Search and rescue aspects. The author will inquire and research in to the wide spectrum of areas which will imply the necessity of having fully fledges Search and rescue capability in order to address the future eventualities that necessitates by SAR function.

The recent recorded incidents of a missing Malaysian Airline MH 370 and Air Asia crash has become an eye opener which highlighted the necessity of having an effective search and rescue capability in a country particularly an island nation as a part of national responsibility which has an international legal obligation. Sri Lanka being an Island nation which lies within considerable number of international air navigation routes within the Flight Information Region(FIR) , waters within Exclusive Economic Zone (EEZ),) and outside the EEZ of Sri Lanka is presently not playing an effective role in search and rescue paradigm.

Further recent history of natural calamities and man involved disasters such as Tsunami, flooding, land sliding, and earth quakes etc. Will always reminds the importance of having an effective Search and rescue arm. Sri Lanka being a country which is in the close proximity of Ring of Fire of indo-Australian plate and being closer to "Java Trench " will become a earthquake prone country which necessitates the round the clock readiness in terms of search and rescue operation (SAR).

Further to above human involvement in offshore related industrial activities such as oil refineries and other offshore related activities has been drastically increased in post war context which need to have 360 degree search and rescue readiness for 24 x 7.

The author will carry out a comprehensive and wide range of analysis in to the possible threat factor that has to be addressed in terms of search and rescue operation and recommend the organisational reforms, technical and equipment advancement, human resource improvement which will pave the way to forming of fully dedicated sustainable search rescue arm ensuring the optimum survivability over the maritime space of Sri Lanka.

Key Words: Nation building; Maritime Security; Search & Rescue

INTRODUCTION

"Whoever controls the Indian Ocean dominates Asia. This ocean is key to seven seas. In the twenty-first century, the destiny of the world will be decided on its waters"

- Alfred Thayer Mahan

The centre of gravity of the world economic hub has shifted westward towards Indian Ocean from Pacific and Mediterranean sea which results in placing the Indian ocean the third-largest in the ranking in the world Sea Line Of Communications. Indian Ocean is home to one of the most important sea lanes in the world. These sea lanes have become a crucial point of vulnerability to many of the global and regional economic giants and potential economic giants in sustaining their economies as well as day today living. This no doubt has added much value to the strategic importance of our region. If we had no crucial Sea Lanes of Communications (SLOC) in our region, many of our issues would have been not even emerged. Any disturbance of SLOC even for few days would lead those dependent states to death in hunger or death in freeze virtually. Transporting more than 80% of world's seaborne trade through Indian Ocean choke points is a clear fact to prove this very fact.

The world depends heavily on sea-borne trade for its continued existence and allowing all countries to participate in the global marketplace in the high seas. Undoubtedly, the economic and political affairs of South Asia have been dominated by the sea. Indian Ocean covers 20% of earth and ranked in third largest water coverage of the world. Indian Ocean Region comprises 38 littoral states, 24 Ocean territories and 17 landlocked countries. Two adjoining seas are connected with the Indian Ocean, the Arabian Sea and the Red sea, covering an area of 169,000 Sq. miles through the striate of Babel Mandeb, and Persian Gulf, through the straits of Hormuz.

With all these vitalities around the waters around Sri Lanka had made Sri Lanka as a important land mass or a transit

point in cooperated with SLOC. Thereby as in Singapore Sri Lanka, over time has become a hub in the world trade in which Sri Lanka will be benefited economically as a nation. Further the geo-strategically importance of Sri Lanka on this regard will emerge the Sri Lanka as a prominent country increasing its power of demanding at international affairs and political affairs significantly. In that aspect Sri Lanka nation building process will be greatly supported by the Sri Lanka's strategically important geographical positioning in Indian Ocean Region (IOR). Hence the demanding power will be largely proportionate with the maritime security of the EEZ and territorial waters of Sri Lanka in which Search and rescue (SAR) operation would play a significant and essential role.

The search and rescue function is a state responsibility which has a legally bound by following international instrument.

- The Convention of International Civil Aviation (Chicago, 07 Dec 1944).
- The International Convention of Safety of Life at Sea (SOLAS) (London, 01 Nov 74 as amended).
- United Nations Convention on Laws of the Sea (UNCLOS).

The key functions of SAR should be to co-ordinate:

- Maritime SAR in offshore, inshore and shoreline areas.
- Aeronautical SAR over land and sea.
- Inland SAR.

Following the adoption of the 1979 SAR Convention, IMO's Maritime Safety Committee divided the world's oceans into 13 search and rescue areas, in each of which the countries concerned have given search and rescue regions for which they are responsible. Provisional search and rescue plans for all of these areas were completed when plans for the Indian Ocean were finalized at a conference held in Fremantle, Western Australia in September 1998. RCC (Rescue Co-ordination Centre) and RSC (Rescue Sub-Centre) should have up-to-date information on search and rescue facilities and communications in the area and should have detailed plans for conduct of search and rescue operations.

METHODOLOGY

Aim of the Study

The aim of the study is to ascertain the gaps between present day search and rescue capabilities of SLAF and fully fledged SAR capability in order to react effectively in terms of SAR in future eventualities.

Objectives of the Study

- In achieving above aim the study will focus on achieving following objectives.
- To analyze the present maritime and global context which necessitates a fully-fledged SAR capability over Indian ocean region (IOR).
- To asses and evaluate the present SAR capability as a nation.
- To study the optimum level of SAR operation capability that has to be acquainted with possessed by Sri Lanka Air Force to cope up with above context.
- To make recommendation to achieve optimum level of SAR capability in SLAF through a comprehensive study on other international SAR discipline taking the national affordability.

Problem Statement

SAR operations in Sri Lanka as an element of maritime operation and an integral component of nation building related activities and affairs as described in the in ' introduction ' of this paper ,is falling far short of the expected ' optimum ' level in terms of accessibility ,technology , and due to many other factors involved. Thus leaving Sri Lanka's IFR region, EEZ ,and territorial waters around this island nation highly vulnerable in terms of life safety and survivability ,Which will intern fragile maritime operations, nation building related maritime activities and other diplomatic opportunities it inherits due to the geostrategic positioning.

After the cessation of more than three decades of protracted war which restricted all nation efforts mainly on war related affairs we as a nation at the peek time to focus attention on uplifting our maritime assets to a fully fledged SAR arm in Sri Lanka Air Force.

Past incidents with regard to disappearance of Flight MH 370 of Malaysia, recent Earth quake in Nepal ,Tsunami catastrophe in 2004 are few examples that clearly shown us the inadequacy of SAR readiness and SAR capability as a nation, besides the fact that we responded to a some degree in those scenarios. Those incidents reminiscence that we are well short of a fully fledged SAR capability as a nation.

Scope of the Study

The study will be mainly focused on air operation related with SAR operation of Sri Lanka Air Force as one of the element in SAR role. Further the study will be more particularly narrowed down to study on utilization of helicopters in SAR operation.

Data collection will be mainly through a comprehensive study on international SAR literature and their outcomes as, first hand information within the Sri Lanka is limited.

SEARCH AND RESCUE OPERATIONS IN SRI LANKA

The Importance of SAR operations in Sri Lankan context

Sea Lines of Communication (SLOC's) : As the center of gravity of the world economic hub has shifted from west seas towards the East the sea lines of communication over Indian sea has become a area of crucial vulnerability. The world's busiest international shipping lines or the Sea Lines of Communication (SLOC's) pass through Southern coast of Sri Lanka just 9.5 km from land. The geostrategic importance of the SLOC around the waters of Sri Lanka has emerged the Sri Lanka and its issues to the world dragging the attention of the world. Further this geographical position has made ample opportunities and potentialities to make Sri Lanka a Asian maritime hub in the world, competing with other prominent hubs such as Singapore and Dubai. Sri Lanka owes the responsibility of addressing any distress situation arises with regard to ships or vessels passes through IOR. It can be a SAR of ship or vessel at distress, distress situation lead by ship wrecked, mechanical failure or a fire i.e., a situation where a passenger or the staff of a ship/vessel who needs medical evacuation or it can be a fire rescue operation from a ship.

Maritime Operations Over EEZ and Territorial Waters:
Intense maritime operations are carried out in terms of maritime operations on involving many of the issues over the EEZ of Sri Lanka by various agencies including Sri Lanka Navy Coast Guards, Sri Lanka Navy, and Sri Lanka Air Force. In that, intense number of vessels and air assets are involved to ensure maritime security mainly In support of operation against Maritime Terrorism, Drug Trafficking, Arms Smuggling, Maritime piracy, Illegal Unreported and Unregulated Fishing, Human Trafficking. These operations itself are prone to any distress situation over see.

Offshore Drilling and Exploitation Related Activities:
Offshore activities of Sri Lanka days back to 1950's. Since then till the recent past offshore activities were not much prominent. Offshore activities with regard to oil and gas exploitation has become a main concern mainly over Mannar basin which will have a direct bearing on nation building processes in years to come after a protracted war of 30 years. These operations overseas some 60-80 NM off coast necessitates a SAR support as these people are vulnerable to distress situation which can arises at any time who needs to be evacuated or brought in to the immediate medical attention.

SAR operation Within FIR of Colombo: The role of Search and rescue within the allocated SAR area Colombo FIR "Annex A" demarcated by Annex 12 of ICAO remains critical point of vulnerabilities as its a vast area of responsibility which has a legal binding as well. The number on international flight paths as well as domestic flight routes which are in frequent operation see "Annex E". The recent crash of MH 370 Malaysian air liner brought in to the light the importance of having fully dedicated SAR capability.

Legal Responsibility of International Laws: State has a legal responsibility of providing SAR facility on demand free of charge to any international flight or vessel within the region. The legal area of responsibility for SAR of Sri Lanka within SAR region and FIR of Sri Lanka is 27 times as the land mass of her. which demarcated by Colombo-Male FIR, Colombo-Chennai FIR, Colombo-Melbourne FIR and Colombo-Jakarta FIR. Sri Lanka is responsible for a sea area of about 1.7 million square kilo meters around the island .The search and rescue services in Sri Lanka is organized in accordance with standards and recommended practices of ICAO Annex 12. Overall responsibility for the administration and for making necessary facilities and services available for SAR operations within Colombo Search and Rescue Region rest with the Civil Aviation Authority of Sri Lanka.

Natural Calamities and Manmade Disasters: Geographic positioning of Sri Lanka in the Indian ocean, Sri Lanka has become an earthquake prone country. As happens in Pacific region due to its positioning around the "Ring of Fire" Indian Ocean countries including Sri Lanka are much more prone to seismic related earthquakes and other catastrophes, as its geographic location is closer to "Java Trench" the seduction zone which formed as a result of the collision between Indo-Australian plate and the Euro Asia plate. The region has a history of Earth quakes and Tsunami.

The earthquakes and Tsunami conditions will create a disastrous condition leading to state of emergency which will require fully fledged SAR capability and its integrated facilities. The extended SAR capabilities will further be an added advantage to address SAR requirement in regional Indian Ocean region countries (IOR) in such situation which will strengthen the regional co-operation. The 2015 earthquake in Nepal, 2004 Tsunami was few out of many catastrophes which highlighted the needed SAR operation.

The weather pattern and adverse depression phenomena has a greater effect on Sri Lanka and Indian ocean region countries. Cyclones and storms are the resultant of above weather pattern over Bay of Bengal requiring a fully-fledged SAR capability over Indian Ocean region mainly for the search and rescue of fishing community.

SAR Operation and Helicopters:Since the state has the responsibility of SAR operations within EEZ and FIR which lies within vertical limit of minimum 200NM range. In Sri Lankan context considering the capabilities of available aircrafts and assets, reach (endurance) and manoeuvring during SAR operation remains a main concern. Though there are fixed wing air craft such as sea planes been used in many other developed countries for the Rescue purposes helicopter will be the best option in this regard in Sri Lankan context considering the available assets. As per the inherent

capabilities such as hovering, maneuverability (forward and backward flying), low speed, bad weather & unfavorable terrain capability, helicopter will be the best option for rescue operation. Further characteristic of versatility in various operations such as winching, Bowman bag operations, Litter operation can be integrated in those missions in helicopter operation. More importantly vertical envelopment ability and landing ability on a deck, helipad and even a rooftop helipad will assist to carry a patient or rescue personnel to a hospital at close proximity for medical attention. This ability will be act as a force multiplier.

Considering Sri Lanka Sri Lanka Navy assets "Annex B " deployed for SAR responsibility ,helicopter operation in this SAR operation give unprecedented and unparalleled third dimensional eye view and significantly higher reach and penetration ability. A fastest Off Shore Petrol Vessels(OPV) cruise at 21Kts , Fast Missile Vessel (FMV) cruise at 32Kts or Fast Gun Boat(FGB) cruise at 27Kts will consume 3-4 times as a helicopter cruising at average speed of 100Kts or 80Kts to reach a location. A "rescue helicopter" is defined as a rotary wing aircraft capable of high altitude, warm weather, and out-of-ground effect (OGE) hovers. The aircraft must be capable of landings in rugged terrain using small unimproved heliports. A rescue helicopter would be used to perform rescue operations, possibly at high altitude. The following are some examples of rescue helicopters used worldwide:

- Aerospatiale Alouette III SA-317B
- Aerospatiale Twin Star AS 355 F1
- Lama SA315
- Boeing Vertol Chinook CH47 C, D or E
- Jolly Green Giant
- Bell 212
- Bell 205 (UH-1H, B, M) - Single-engine Huey
- Bell 412 (UH-1N) - Twin engine Huey
- Bell 214 ST
- Bell 414 ST
- BK 117
- BK 105
- Dornier
- Cheaak
- Sea King
- Kamov

PRESENT STATE OF SAR OPERATIONS IN SRI LANKA AIR FORCE

Present state of SAR capability of Sri Lanka Air Force helicopters dedicated to SAR operation are listed in the following table -1 below. Their basic performances and deployment is as per the chart.

Considerable numbers of SAR operations have been carried out by Sri Lanka Air Force utilizing helicopters and have saved many lives in distress situations both over land and sea.

The success story behind those operations were mainly based on the effective use of helicopters and other air assets in those occasions ,the operational readiness , correct and timely use, and operational proficiency.

The history provides us many success stories on SAR operation especially in Tsunami, flooding, storms and other adverse weather conditions. Bell 212 helicopters, Bell 412 helicopters, MI 17 helicopters were used in SAR role using available equipment such as Winch, Ropes, and onboard lifesaving equipment.

LOCATION	HELICOP-TER TYPE	PERFORMANCES			TYPE OF SAR	CAPABILITIES OF AIRCRAFT			
		RANGE *	SPD*	SAR EQUIPMENT		NVG	FLIR	AFCS	FLOATS
Ratmalana	MI 171	100 NM	200km/h	WINCH	RESCUE/MEDEVAC (01)	NO	NO	3 AXIS	NO
	Bell 212	70 NM	100 knots	01 WINCH & 01 BOWMAN KIT	RESCUE/MEDEVAC/HEMS(01)	NO	NO	NO	NO
	Bell412	80 NM	120 knots			NO	NO	3 AXIS	YES
	Bell 412 EP	90 NM	120 knots			NO	NO	3 AXIS	NO
Anuradhapura	MI 171			NIL	ROPE RESCUE ONLY	NO	NO	3 AXIS	
Hingurakgoda	MI 171			NIL		NO	NO	3 AXIS	NO
	Bell 212					YES	NO	NO	NO
KKS	Bell 212					NO	NO	NO	NO

Table 1: SAR helicopter deployment of SLAF and their capabilities

* Range has been calculated considering maximum of 0.30 mnts operating time over the rescue point with minimum returned fuel reserve of 200 Lbs. Doors removed configuration will reduce the cruising speeds.

* 01 fully equipped most sophisticated Ambulance kit is available at No 04 Helicopter Squadron which is compatible with Bell 01 X Bell 212 ,02Bell 412. List of Equipment and apparatus available in the ambulance kit is attached as "Annex C".

Further to above MEDEVAC or helicopter emergency medical support (HEMS) operations from ship decks has been carried out by Bell 412 helicopters in recent past at number of occasions with available resources.

Presently No 4 Helicopter Squadron has a dedicated well sophisticated next generation Ambulance helicopter at round the clock readiness state to counter any Helicopter Emergency Medical Service (HEMS) operation in support of rescue/MEDEVAC. List of available equipment and apparatus in the MEDEVAC kit are listed in "Annex C". This is the most sophisticated and next generation Ambulance (HEMS) kit in South Asian Region which has become a plus point in SAR context.

REVIEW ON SAR OPERATIONS IN WORLD LITERATURE

This study will mainly focus on the methods and technologies used with regard to Air-Sea rescue world widely. Technologies integrated with naval search and rescue operations will not be focused in this review.

USA

The Search and Rescue Mission Office at NASA's Center in collaboration with several government agencies, has developed a next-generation search and rescue system, called the Distress Alerting Satellite System (DASS). NASA, the National Oceanic and Atmospheric Administration (NOAA), the U.S. Air Force, the U.S. Coast Guard and other agencies, are now completing the development and testing of the new system and expect to make it operational in the coming years after a complete constellation of DASS-equipped satellites is launched.
When it goes online, DASS will be able to almost instantaneously detect and locate distress signals generated by 406 MHz beacons installed on aircraft and vessels or carried by individuals, greatly enhancing the international community's ability to rescue people in distress. This improved capability is made possible because the satellite-based instruments used to relay the emergency signals will be installed on the U.S. military's Global Position System (GPS), a constellation of 24 spacecraft operating in mid-Earth orbit (MEO).

Denmark

Search and Rescue operators in Denmark are primarily: Danish air force Squadron 722, Danish navy air squadron, naval home guard and the Danish Maritime Safety Administration, coordinated by the Joint Rescue Coordination Centre, operated by the navy and air force in the Danish Naval Commands facilities near Aarhus. Internationally the Danish works mainly with Germany, Norway and Sweden. With the two latter, the annual exercises Baltic SAREX and Scan-SAR are conducted.

SAR services in Denmark started in 1957 with seven Sikorsky S-55s. Their piston engines produced only 550 hp (410 kW) and they had limited fuel capacity, so their operational range was short. To increase the operational area, Pembroke twin-engine fixed-wing aircraft were employed for search. These aircraft would localize the distressed person(s) and the S-55s would then rescue them.

In 1962 eight ship-based Aerospatiale Alouette IIIs were received. These were primarily meant for the ships patrolling the North Atlantic, but also supported the S-55s. In 1964 - 1965 the seven S-55s were replaced with eight Sikorsky S-61A helicopters. This helicopter was originally designed frantic, but the Danish variant had the heavy dipping sonar equipment removed and extra fuel tanks added, giving the helicopters longer range. In 1977 radar was installed and in 1990 FLIR was added. Further avionics and navigation systems, including GPS, have also been added over time.

In 1977 the naval air squadron was re-established as an independent squadron in the navy and had their Alouette IIIs replaced with Lynx helicopters. Their primary operational area was still the North Atlantic, but they continued their support role, although this was reduced with the introduction of the S-61s. In 2006, the first of the S-61s was replaced by one of 14 new AgustaWestlandH101 Merlin helicopters.

Germany

Search and Rescue in German waters is conducted by the German Maritime Rescue Service GMRS) with air support by the German Navy and the German Air Force. All incoming requests are coordinated by the Maritime Rescue Coordination Center in Bremen. Besides the offshore Search And Rescue services, the German Air Force provides 8 SAR Command Posts on a 24/7 basis with the Bell UH-1D Huey. Further, the key component of the German disaster relief framework. It is, among other things, regularly involved in urban search and rescue efforts abroad.

Royal Danish Air Force

Royal Danish Air Force (RDAF) the purchased of eight EH101s for SAR duties .Further Danish AW101s have a higher gross weight capacity of 15,600 kg and were, as delivered, coated in a paint designed to reduce the aircraft's infrared signature.

Danish AW101s, these included the addition of electronic warfare pods and a new electro-optical system In September 2013, Danish AW101s were to receive L-3Wescam MX-15 electro-optical/infrared (EO/IR) sensors; SAR aircraft already carry the FLIR Systems Star Safire II EO/IR sensor.

United Kingdom

The search and rescue helicopters are equipped with an hydraulic hoist rated at 600lb. The radar is either the Thales Defence ARI5955 or Telephonic RDR-1500B. The Norwegian Air Force Sea King is also equipped with the Telephonic RDR-1300C nose radar.

Agusta Westland was awarded a contract in 1995 to build three new mk3A search and rescue helicopters and to upgrade the Royal Air Force mk3 fleet to mk3A standards. The new systems include Thales Defence ARI 5955/2 radar, Thales Defence RNAV-2 navigation system, Thales Defence Doppler 91 and Cossor STR2000 global positioning system.

With the helicopter configured in the search and rescue role, the cabin can accommodate up to 22 survivors or nine stretchers and two medical officers.

UK Royal Air Force search and rescue Sea Kings are fitted with the FLIR Systems Sea King multisensory systems (SKMSS). The system entered service in June 2004.

India

Presently, Indian Coast Guard has Chetak single engine helicopter based at Daman, Mumbai, Goa, Chennai and Port Blair and Advanced Light helicopter (ALH) based at Goa, Porbandar. The Chetak helicopters are capable of operating from the decks of Offshore Patrol Vessels and Advanced Offshore Patrol vessels. The Chetak is capable of operating from other ships of Indian Navy also. Advanced Light Helicopter, which has twin engine and enhanced capabilities in terms of endurance and other operating factors, can operate from the decks of AOPV. In addition to these, Indian Navy has also helicopter placed at Mumbai, Kochi, Goa, Visakhapatnam and Arkakonam operating twin-engine helicopters namely Sea King, Kamov and Chetaks.

The Advanced Light Helicopter (ALH) is designed as a multi-role helicopter for both military and civilian use. The helicopter used by the Coast Guard is fitted with surveillance radar, a Forward Looking Infer Red (FLIR), troop seats and a life raft along other for various requirements. It is powered by two TM 333-2B2 turbo shaft engines that generate a maximum speed of 290 km/hr and a cruising speed of 253 km/hr. The ALH is capable of carrying an external load of 1500 kg over a distance of 216 run. The Coast Guard is presently operating 04 ALH at different locations.

Chetak is a light weight multi role helicopter capable of carrying 750Kg load under slung in case of emergency. The Chetak has a flight endurance of approx 540 km (290 nm) or 2 hours 30 min over land or sea with a maximum speed of 113 knots. This helicopter is also capable of embarking on all the Adopts and Opts presently in service in the Coast Guard for search and rescue and utility services. The Coast Guard is presently operating 17 Chetaks at different locations.

The Dornier 228-100 turbo prop twin engine is a new generation commuter and utility aircraft incorporating advance technology in design and manufacture. It is high performance aircraft with short takeoff and landing during day or night and fly -by-wire features. It has a long flying endurance, usually up to five hours, all at unusually low operating cost. With a maximum speed of 472 km/hr and a service ceiling of 28,000 ft. -It has range of 2445 km. Presently Coast Guard is operating 24 such aircraft.

RECOMMENDATIONS

Recommendations will be made to upgrade the existing SAR capabilities in to an “optimum” level, based on the observations made, and through a comprehensive study of the SAR operations and the strategies used in other states in support of maritime operations. The importance of the maritime operations, assets available with other agencies involve in maritime operation & SAR role i.e. SL Coast Guard, SLN and most importantly the economy factor of the country will be taken in to consideration when making recommendations for the upgrading and technological advancement.

It is utmost important to establish a fully dedicated SAR element in SLAF with required upgrading to meet up with maritime SAR role over within FIR of Colombo (VCCC) and covering waters within EEZ. The area of responsibility of SAR is 27 times larger as the land mass of Sri Lanka.

Coordination between all agencies such as Aeronautical Rescue Coordinating Centre (ARCC), SLNCG, SLN, disaster management centre (DMC), SLAF SAR element for quick response after distress signal received. Joint exercises should be carried out with participation of all parties involved.

It is necessary to have a SAR Joint doctrine defining the role and task, operation procedures in order to minimize the confusion and reduce the reaction time.

The SLAF SAR element need to have a helicopters with extended range (endurance) which can operate prolonged duration over distress point and have the ability of reaching the boundary of EEZ or operate within FIR for any recue purposes and return with minimum fuel intact. To achieve this flexibility amidst the unavailability of force multipliers such as aircraft careers or deck landing facilities, SLAF can resort to a helicopter with a greater endurance i.e S-52 Sikorsky S-61A, HH-60, Euro copter UH-72, Euro copter HH 65 Dauphin etc.

Further Avionics package has to be upgraded to 4 axis AFCS with auto tracking to rescue point when coupled with GPS and auto hover ability which will be a critical factor to reduce the work load of pilots especially in night operations

and poor visibility conditions as there won't be any reference points available during offshore operations. See Figure-2 in "Annex E" Searches are generally carried out visually but can be enhanced with
the use of the Multi Sensor System (MSS) this has a Forward Looking infrared (FLIR) and high quality digital TV cameras, or with the use of Night Vision Goggles (NVGs) in specific circumstances.

Further we can utilize available FLIR cameras and NVG Night visions presently at SLAF after converting cockpits and instruments NVG compatible by improvising local modifications. Competent technical crew, knowledge and recourses available in SLAF which will save considerable amount of money.

Effective deployment and establishment of rescue units including helicopters , Survival equipment and apparatus i.e. Hoist, Winch ,Ropes, survival dinghies has to be planned considering the geography of Sri Lanka's maritime waters i.e. Southern and eastern sea around Sri Lanka has wider and longer maritime area comparatively to other parts of Sri Lanka.

SLAF can establish a dedicated SAR fleet consist of SLAF helicopter pilots, helicopters and crew which can be integrated with Sri Lanka Navy Course guard to take over the task of Maritime SAR.

Pilots should be conversant with search patterns and offshore operations such as approach, take off, landings on a deck or ship and emergency ditching procedures etc. Trainings on simulators will enhance the proficiency of the pilots on SAR operations.

It is suggested to use a UAV or long range fixed wing aircraft for search function and subsequently to us a dedicated rescue helicopter till SLAF acquire a helicopter with higher endurance.

Deck landing facility with basic infrastructure facility such as refuelling to be established on ships or Naval vessel in order to support SLAF SAR operation. Further the same platforms can be utilized to operate UAVs.

ACKNOWLEDGEMENT

My sincere thank goes to Air Cdre HMSKB Kotakadeniya for the initiatives and encouragement given during the study.

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I should be thankful to Air Cdre DJC Weerakoon for the support and directions given me as the Moderator.

My heartfelt thank goes to my loving wife and two kids for tolerating me and sparing their time during the study.

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Annex "A"

Designator	Position	Significance
A 100 00'N	800 00'E	Reference Point
B 100 00'N	820 00'E	Reference Point
C 060 00'N	780 00'E	Reference Point
D 060 00'N	920 00'E	Reference Point
E 020 00'S	780 00'E	Reference Point
F 020 00'S	920 00'E	Reference Point

SAR responsible area of Sri Lanka

Annex " B "

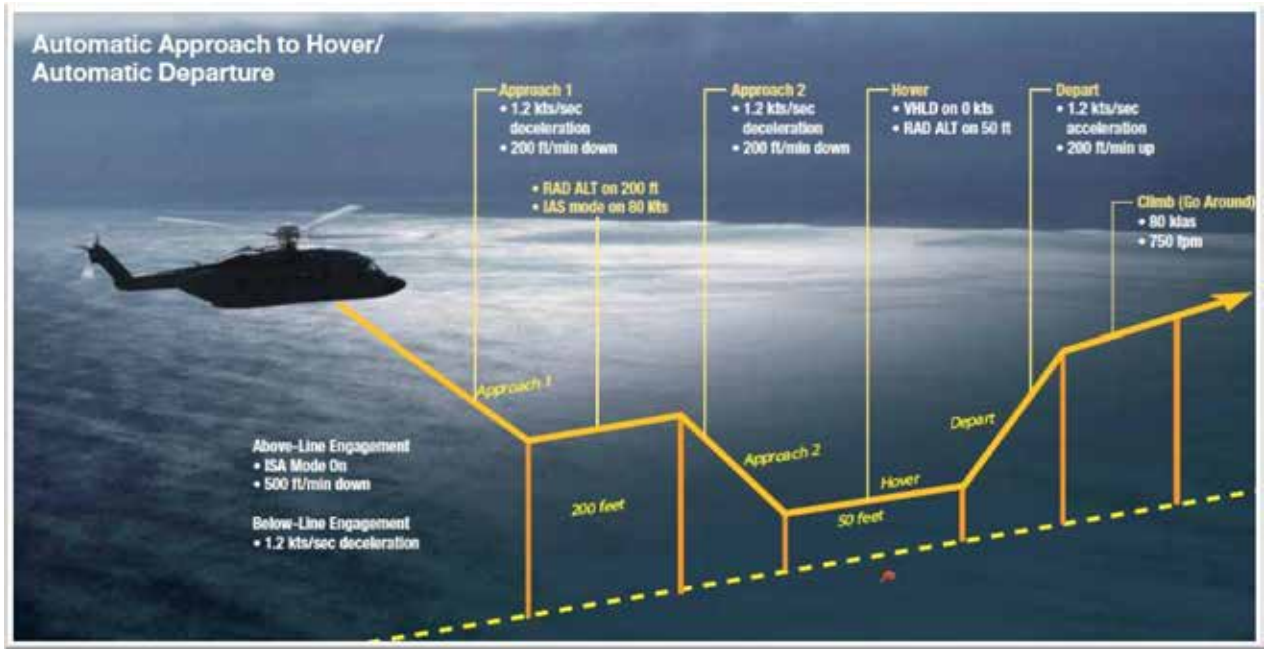
NAME	LOCATION	FACILITIES	REMARKS
COLOMBO	065621.49N 0795055.33E	i) Off Shore Petrol Vessels (OPV) (1 unit)	Could carry Four Hundred Fifty (450) casualties.
			Speed: 21 KTS
			Range: 5800NM at 15KTS
		ii) Fast Missile Vessel (PMV) (1 unit)	Could carry Seventy (70) casualties.
			Speed : 32 KTS
			Range : 1650NM at 30 KTS
			4000 NM at 17.5 KTS
		iii) Fast Gun Boat (FGB) (1 unit)	Could carry Twenty (20) casualties.
			Speed : 28 KTS
			Range : 750 NM at 16 KTS
GALLE	060202.24N 0801354.36E	i) Support/Training Ship (AA/AX) (1 unit)	Could carry Three (300) casualties.
			Speed : 10 KTS
			Range : 5500 NM at 09 KTS
		ii) Fast Gun Boat (FGB) (1 unit)	Could carry Twenty (20) casualties.
			Speed : 28 KTS
			Range : 750 NM at 16 KTS
TRINCOMALEE	083242.37N 0811319.64E	i) Off shore Patrol Vessel (OPV) (1 Unit)	Could carry Four hundred (450) casualties.
			Speed : 18 KTS
			Range : 6100NM at 14 KTS
			2700 NM at 18 KTS
		ii) Fast Missile Vessel (FMV) (1 unit)	Could carry Seventy (70) casualties.
			Speed : 32 KTS
			Range : 4000 NM at 17.5 KTS
		iii) Fast Gun Boat (FGB) (1 unit)	- Could carry Twenty (20) casualties.
			Speed : 28 KTS
			Range : 750 NM at 16 KTS
KANKASANTH-URAI	094909.67N 0800206.10E	i) Landing Ship tanker (LST) (1 unit)	Could carry Three Hundred (300) casualties.
			Speed : 14 KTS
			Range : 1000 NM at 12 KTS
		ii) Fast Gun Boat (FGB) (1 unit)	Could carry Twenty (20) casualties.
			Speed : 28 KTS
			Range : 750 NM at 16 KTS

Search and Rescue Vessels and their basic capabilities of Sri Lanka Navy

Annex " C "

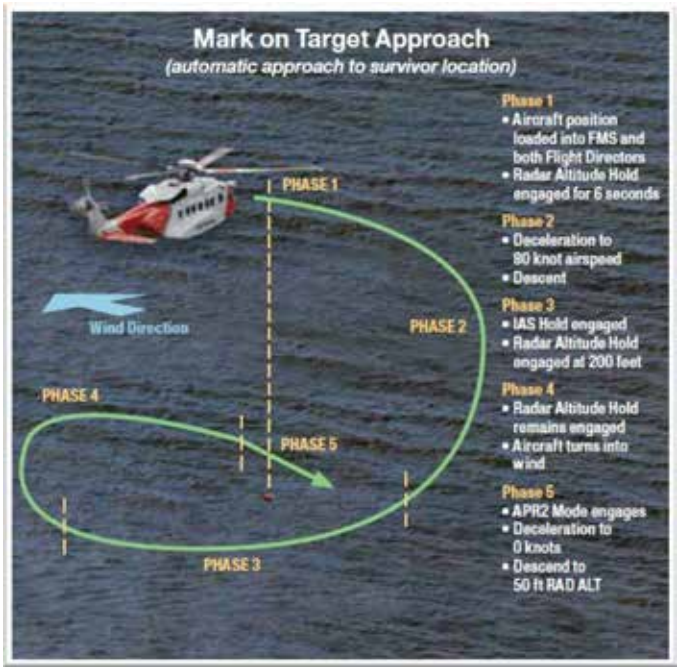
Multi parameter with De Fibrillator and External pace maker	To monitor patients vital parameters such as BP, PR, RR, Temperature, Oxygen saturation and ET CO2. Defibrillation of the patient in a cardiac arrest.
Ventilator with Flow sensor	To give Positive Pressure Ventilation
Infusion pump	To supply continuous infusion of emergency medication
Syringe pumps X 3	To infuse emergency drugs in small quantities
Oxygen cylinder-compressed gasox 3500L	Storage of Oxygen to ensure continuous supply of Oxygen to the patient on air.
Pressure regulators	Regulation and maintenance of continuous oxygen delivery to the patient.
Oxygen Flow Meter	Regulation and delivery of humidified oxygen in desired rate to the patient.
Oxygen tubes and masks	Delivery of Oxygen to the patient
Suction apparatus	Suction of patients secretions in an emergency
Air compressors X 2	To be used for ventilators in failure of Oxygen system
Manual loader	To smooth loading of the patient in to the Aircraft

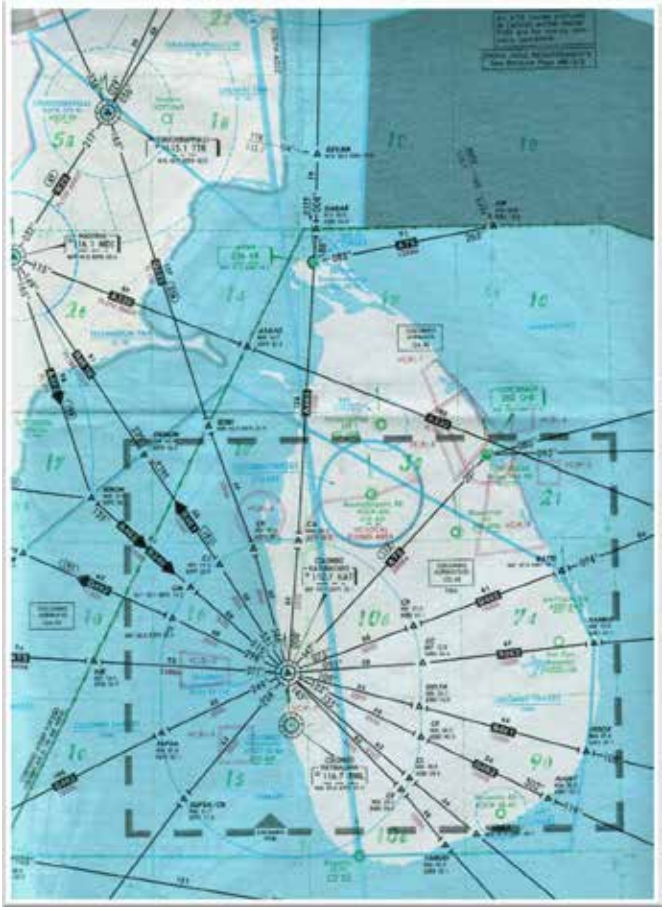
Automatic approach to hover /departure and Mark on target approach



List of apparatus and Medical equipment of Ambulance kit available at No 4 helicopter squadron

Annex "E "





International Flight Routes Over Sar Responsible Area Of Sri Lanka

THE ROLE OF SLAF ELITE FORCES IN MARITIME SECURITY: AIR MARITIME PERSPECTIVE

By
Wing Commander SPVK Senadheera
RSP, MDS, BA (Def Stu) ,psc, AMITD

Abstract — Security assurance across maritime resources of an island nation is a critical factor for ensuring territorial integrity, sovereignty, national interests and objectives. Realizing the importance of the same aftermath of the three decades of war with the LTTE, a number of initiatives are currently underway focusing on some important maritime security issues in Sri Lanka. As an island nation, the main purpose of the above initiatives is to reduce the likelihood of maritime vectored terrorism, movement of undesirable elements by means of domination of the Maritime domain and also to ensure a safe passage all the way through effective and efficient Airborne Maritime Security Operations (AMSO) and Airborne Search and Rescue (ASAR) operations.

This paper intends to identify the role of the Regiment Special Forces (RSF) – the SLAF's unique elite infantry force – in maritime security, and explore the possibilities in entrusting RSF to engage with the challenges in Air and Maritime perspectives. Also the paper highlights the existing maritime threats and challenges faced by Sri Lanka, need for an integrated framework with Sri Lanka Navy (SLN) to conduct maritime air operations blended with RSF troops for enhanced AMSO/ ASAR and other crisis management capabilities.

As a part of ensuring maritime area domination and continuous presence in the Sri Lankan waters, this paper identifies the strengths and weaknesses of each force and suggests a standard Maritime Air Organization (MAO) structure and a new scheme for achieving optimum results with SLN, SLAF air and RSF capabilities. The paper finds that there is a need and opportunity available to offer the unique capabilities of RSF troops in maritime security issues and also on humanitarian grounds to the large number of ships that enter and sail through Sri Lanka's territorial waters by assuring a safe and secure passage as a responsible coastal state.

In order to ensure substantial maritime security within our area of concern, it is deemed necessary to have a formidable law enforcement and security presence supported by a quick response platform as a deterrent measure. In this context, having a common standard operating structure based on the capabilities and limitations of individual forces is not something optional. This paper identifies that, unless and until such coordinated and concerted operational mechanism is put in place, it would be difficult to achieve the core objective of nation building through effective maritime security provided by SLN, SLAF air and RSF components.

INTRODUCTION

Sri Lanka's geographical location has, traditionally, represented a significant point in the Indian Ocean region. Since the ancient history, maintaining of a maritime domain became an important factor to Sri Lanka being an island that lies near to a regional super power and also near the main sea route connecting West to East of world. The air component has become one of the main instruments of maritime power, not only in its offensive capability, but also in its ability to undertake many of the traditional roles performed exclusively by surface units. As far as the sea warfare is concerned, Naval and Air Force strategies have merged and brought about a closer affiliation which is now being reflected in a joint approach to maritime strategy.

Along with the end of the three decades old internal armed conflict in Sri Lanka, taking a broader approach was observed in ensuring sovereignty and territorial integrity of the country at an integrated and joint platform where all three services work together. Planning framework for SLN and SLAF in security cooperation is of paramount important enabling organizations to achieve an integrated maritime approach to security cooperation in support of national security objectives through effective utilization of available resources. An integrated maritime approach to security cooperation will enable a sizeable, enduring and comprehensive contribution to security and stability in the maritime domain.

AMSOs are the actions of a country's military forces to "combat sea–based terrorism and other illegal activities, such as hijacking, piracy, and human trafficking." Troops assigned to such operations may also assist seafaring vessels in distress. Further, this will be done in pursuit of a nation's policy, strategy and tactics at sea to achieve following objectives:

- Promoting a secure international maritime domain and upholding international maritime norms.
- Developing the maritime governance capacity and capabilities of states in areas of strategic maritime importance.
- Protecting the country, its citizens and economy by supporting the safety and security of ports and offshore installations and passenger and cargo ships.
- Assuring the security of vital maritime trade and energy transportation routes within Sri Lankan Marine Area.

Maritime Security" plays a key role mainly because it remains as a key component of the national security at large. Maritime security assists in providing a stable and a peaceful socio-political and administrative background in the country to foster sustained profitability and growth for maritime industries. It also covers the aspects of protecting and defending the integrity of the country's marine resources and also ensures preparedness for an effective response to natural disasters as well as manmade disasters.

The military dimension of maritime security component is specifically designed to enhance, conserve and protect territorial integrity and coastal peace and order. Basic components of maritime security which are covered both by UNCLOS and various other International Agreements pay special attention to the following aspects

- Monitoring innocent passages through our waters.
- Activities in our EEZ.
- Monitoring and enforcement of environmental laws, rules and regulations.
- Concern on food security laws, rules and regulations along with fishing incursions by foreign ships in EEZ.

There is a high risk of negative consequences to a State which does not provide adequate safety and security to aircraft or vessels which are passing its SLOC for legitimate purpose. A poor response and insecurity status over country's SLOC will result in damage to that State's reputation internationally and potential economic loss to sensitive State industries such as tourism and transport. It is presumed that the SLAF's elite, RSF troops has the potential to act as Maritime Safety and Security Teams (MSSTs) to provide waterborne anti-terrorism, anti piracy, force protection tasks as a quick response force capable of rapid deployment via air transportation in response to changing threat conditions.

An effective and reliable maritime security system of a country offer many benefits and advantages. Besides reduction of loss of life and human suffering, other advantages include the following aspects.

- Safer and more secure environment for aviation and maritime related industries, commerce, recreation and travel. Increased safety may promote use and enjoyment of aviation and maritime environments, tourism and economic development.
- Availability of maritime safety and security resources often provides the initial response and relief capabilities critical to saving lives in the early stages of disasters. SAR services offer an integral part of local, national and regional emergency management systems.
- Well performed AMSO will provide positive publicity leading to improve public confidence in that State's reputation and commitment to providing a safe environment which in turn will beneficial to that State's economy and also to the Nation Building effort.
- Timely and quick conduct of maritime security operations is an excellent opportunity to enhance cooperation and communication which can foster better working relationships between States and organizations at the local, national and international levels, including civil/military cooperation.

In this context, SLAF can thrive as one of the key stakeholders in ensuring maritime security, by exploring the unique advantage of strategic positioning of Air Bases closer to sea, air capabilities blended with highly skilled RSF which can meticulously contribute to this enduring effort. The RSF being the SLAF's elite force it has the potential and capability to engage in this novel and challenging task, more significantly by exploring avenues and opportunities in order to endorse an aggressive domination in Sri Lankan Air and Maritime perspectives by conducting effective AMSOs.

AIM

To evaluate the major threats, challenges and opportunities available in Sri Lankan maritime domain vis-à-vis the role of SLAF Elite Forces and propose a viable maritime security plan to bolster the Nation Building effort.

OBJECTIVES

The following objectives are set in conducting the research.

- To study about the SLAF Air and RSF capabilities and how they can be mixed in order to conduct effective and efficient AMSO.
- To examine the present situation of the maritime security and how and what limitations are detrimental to SLAF Air and RSF troops in conducting AMSO jointly with SLN.
- To evaluate whether the SLAF has fully contributed its Air and RSF capabilities in conducting AMSO to a Nation Building effort.
- To identify future potential in conducting AMSO by developing SLAF Air &RSF capabilities as a Nation Building activity and make recommendations to design a more effective integrated maritime security plan.

RESEARCH PROBLEM

Sri Lanka's SLOC is a critical component of the national economy, and disruptions in this represent a threat to the overall economic well-being of the country as well as of the world. A great responsibility lies on SLAF and SLN to hold and secure its maritime boundary from any kind of adversary by providing a safe passage for friendly nations through aggressive dominance and quick emergency response etc. In this backdrop, a problem occurs whether the SLAF has sufficiently contributed to the above national effort other than its primary role of defending the Sri Lankan air space. A lacuna is observed in terms of SLAF utilizing its unique Air Power with speed, reach, and height together with its well competent elite forces on maritime security aspects

SCOPE

"Maritime Security, Air and Maritime Perspectives" is a vast area to be covered. Hence, the scope of the research was delimited to studying only on conducting selected AMSOs by utilization of SLAF air and RSF components, depending on their existing capabilities.

DATA COLLECTION

The method of data collection is based on primary and secondary methods. Direct interviews were conducted with the SLAF and SLN officers involved in Air, RSF and Naval operations. In addition some operations managers of leading shipping lines and Secretary General of Ceylon Association of Ships' Agent (CASA) were interviewed. Some records of all maritime incidents reported during the year 2015 to date were obtained from MRCC. Furthermore, the secondary data was collected analyzing previous researches, articles and web data related to maritime security in the Sri Lankan and international context through internet.

METHODOLOGY

This is a research paper which focuses on qualitative values on the role of SLAF elite forces. Having gone through the theme and intended area of study on the topic of "The Role of SLAF Elite Forces in Maritime Security: Air and Maritime Perspective" following procedure is adopted in order to find a pragmatic way to employ the RSF personnel along with SLAF's air capabilities in maritime security. Therefore, following methods of operationalization is used to identify how independent variables affect on improving the dependent variable, "Role of SLAF Elite Forces in Maritime Security".

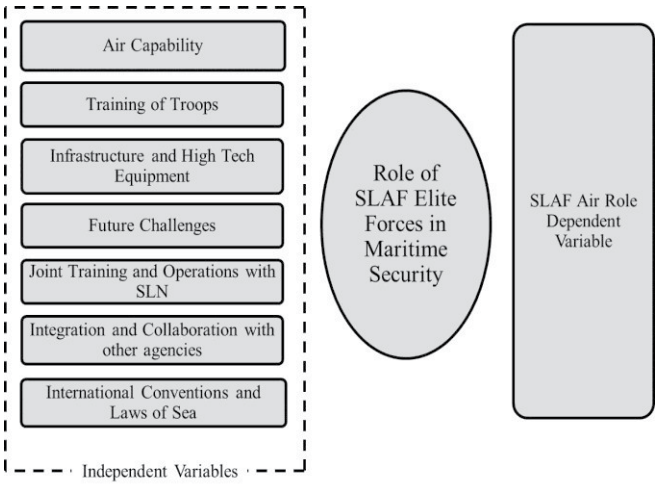


Figure 1: Research Framework

RESEARCH DESIGN

This paper attempts thorough understanding of the risks we face, coupled with an ambitious but pragmatic approach to the opportunities we could undertake in combining Air power, RSF and SLN components to oversee capacity building, deterrence and diplomacy to disrupt potential future maritime challenges before they appear. Hence, the research is designed as follows.

The research framework first identifies the existing /future maritime security challenges in the Sri Lankan maritime domain and highlights the need for an operational coordination platform for integrated command and control requirements which being the Maritime Air Organization (MAO) and Maritime Rescue Coordination Centre (MRCC)at Navy Headquarters Colombo. Then developing the measures to coordinate with MAO, MRCC and other organizations by conducting a realistic assessment on operational capabilities and limitations of SLAF, RSF and SLN in maritime security environment. Then the research finds how SLAF Air, RSF and SLN efforts are channeled to attend the maritime security situation.

Finally identifying issues, challenges and opportunities, the paper proposes recommendations based on the same.

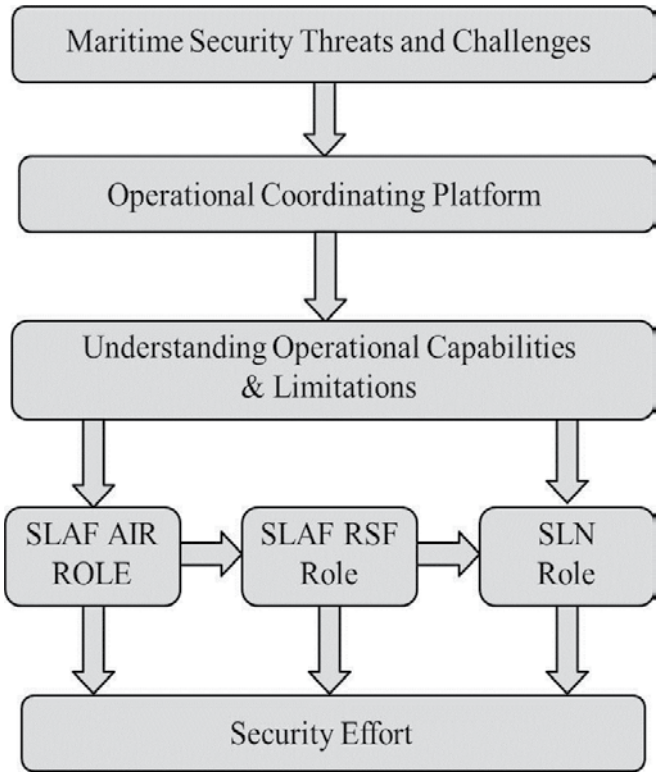


Figure 2: Research Design

SECURITY CONCERNS/ CHALLENGES IN SRI LANKAN MARITIME DOMAIN

The importance of having a safer maritime environment is crucial to an Island nation like Sri Lanka. In Sri Lanka's security environment, the sources of threats as well as their targets have thus become more diverse. Threats from non-state actors at sea, be it terrorists, pirates, or organized crime, have gained increasing prominence. Additionally, maritime threats pose challenges not only in terms of naval power and dominance, but also in terms of economic welfare, protection of the environment, and the integrity of our societies. The following security concerns/challenges are found in Sri Lanka's maritime environment and responding to them with an effective and efficient integrated mechanism is of paramount important.

Drug Trafficking and Arms Smuggling

Drug trafficking and arms smuggling is an important aspect whilst considering the maritime security. Due to huge profits, drug trafficking has become one of the most money-spinning means, which is used to finance terror networks and arms trafficking. Heroin is routed via Sri Lanka from Pakistan or India on a big scale by sea by containers and mechanized fishing craft. Nullifying drug trafficking and arms smuggling is one of surpassing security challenges which will Sri Lanka encounter.

Maritime Piracy

Since 2007 Sea piracy has become a considerable impediment to global maritime commerce. In 2010, 86% of piracy activities worldwide were committed by Somali pirates. Since 2010-2011 the numbers slightly decreased only four maritime piracy incidents were reported.

Unreported and Unregulated Fishing

There have been problems relating the illegal unreported unregulated fishing activities all over the country's EEZ. To name few, bottom trawling, use of illegal fishing nets and use of explosives and poisons etc. Sharing of fishery resources with neighbouring countries, for instant, the intrusion of Indian trawler fishermen in Sri Lankan waters is a huge challenge ahead of the country.

Human Trafficking

Illegal migration is committed mainly for economic reasons and geographical location of the Sri Lanka is one of the closest reasons for rising human trafficking. This trend has been considerably diminished due to higher level of vigilance of SLN and in year 2014 only one boat apprehended with 51 onboard.

Respond to SAR Incidents in SAR Region

Sri Lanka is obliged respond to any SAR incident in its SAR region and this is a quite big challenge as Sri Lanka's SAR region is about 27 times of her land mass. The incident responds are coordinated through MRCC which is situated at Naval Headquarters, Colombo. The information on ships at sea will be obtained through the courtesy of the Automated Mutual Assistance Vessel Rescue System when required. It is also combined with Aeronautical Rescue Co-ordination Centre (ARCC) and other agencies.

Protection of Maritime Economic Resources

Being an island nation, Sri Lanka is blessed with enormous ocean resources, and related opportunities, that can be utilized for the country's economic development. A number of economic activities including tourism, fisheries, and the possible discovery of oil and gas resources in the Mannar Basin will open new avenues for novel economic activities which can have significant impacts on Sri Lanka's economic growth. Hence, conducting aggressive AMOS for the protection of these resources is essential.

Protection of Vital Harbours

Protection of vital harbours in the country is also an important maritime security aspect and SLN plays a pivotal role of protecting vital harbours and keeping the SLOC intact. Concerns of the International Community as well as many shipping agents were high regarding the security aspects of the ports as well as the seas around the country. As a result of this development, a war risk-related insurance premium was introduced.

Progression of the Global Maritime Logistic Network

As maritime trade has grown in global importance, its system of sea routes and ports has become increasingly vulnerable to disruption. This is a new challenge faced by Sri Lanka where it has to be ready to face the expected boom in the industry with an effective maritime security system. Assuming no major upheaval in the world economy, global seaborne trade is expected to increase by 36 per cent in 2020 and to double by 2033.

Many of these challenges are not – or not exclusively of a military nature, and thus require a combination of military and other tools. The capabilities of SLN, SLAF Air and RSF can provide a good illustration of the globalization of security, which is the necessity to Sri Lanka in tackling threats at her source, often in faraway theatres, in order to defend national security and economic interests.

Type of Emergency	No. of Incident	Handled by SLN MRCC	Handled by other agencies (Shipping agent, ownres of the vessel)	SLAF Support
Serious sickness of crew members	13	10	03	Nil
Technical failures	61	08	53	Nil
Loss of communication	12	04	07	01
Collision and capsised vessells	04	04	Nil	Nil
Fire on board	01	01	Nil	Nil
TOTAL	91	27	63	01

Table 1: Summary of maritime incidents reported in year 2015 to date

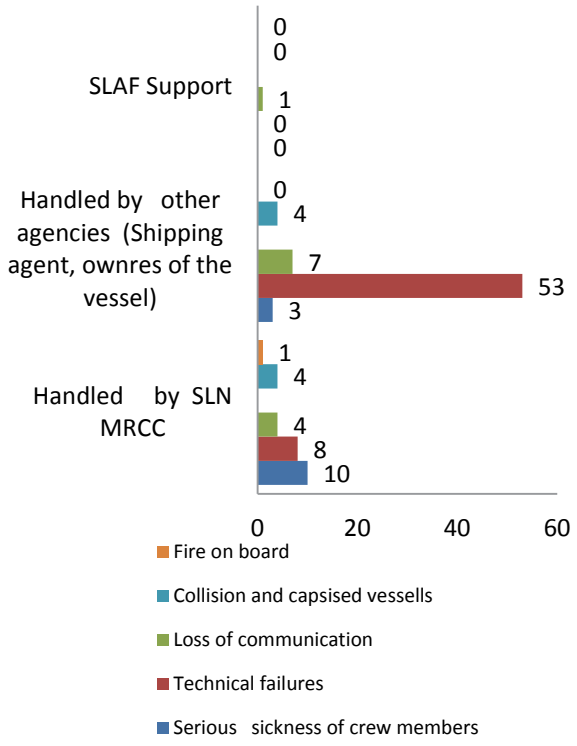


Figure 3: Summary of incidents reported to MRCC
Source: Records available at MRCC

The above data clearly shows the low magnitude of involvement of SLAF air or RSF capabilities in condcuting ASAR operations or providing other assistance such as air survellance etc. A country's quick and timely response to any maritime safety and security situation is a significat feature in ensuring the martime security. Albeit this safety and security incident response is a high risk and costly activity for a nation, the goodwill and amount of reputation it gains in the international arena is enormous. Since, this effort will indirectly help to project the national will and power; a coordinated effort is required for Sri Lanka to ensure maritime security.

However, it is imperative to scrutinze the data at Table: 1 carefully to identify what, where and why SLAF has not been involved in the above eventualities and to see how SLAF will make use of its air and elite arms during this kind of emergency situations in future.

IMPORTANCE OF CONDUCTING AMSOS WITHIN SRI LANKAN SAR REGION

Having discussed the challenging nature of the maritime environment in Sri Lanka, strategic importance of the Indian Ocean and the much important security threats and challenges, it is worthy to study the role of SLAF in relation to the maritime security aspects in the Indian Ocean. The Indian Ocean is fast becoming one of the most important ocean masses in terms of global maritime trade as the key arteries of the maritime shipping trade which run South of Sri Lanka. Even a slightest disturbance to any of the ships that transit the Southern tip of Sri Lanka could cause a major impact on the international maritime trade. On average, over 200 ships transit daily South of Dondra Head to the West and the East. One can imagine the impact it would have on the international maritime trade.

A country's response in maritime security is also a matter with conducting effective and efficient SAR co-ordination and services for their territories, territorial seas, and, where appropriate, the high seas. SAR services are to be available on a 24-hour basis. To carry out these responsibilities, a State should establish a national SAR organization in the given area of responsibility to provide responses to distress situations.

Sri Lanka as a maritime security provider is required to perform incident monitoring, communications, co-ordination, and response functions. This includes providing or arranging for medical advice, initial medical assistance, or medical evacuation, if necessary. The effective employment of Sri Lanka's Air and Naval power in detecting, deterring delaying or destroying all undesirable elements of its sea would definitely enhance the safety and security of legitimate users. Ensuring the same through AMSOs, SLAF can positively contribute to the Nation Building effort.

Figure 3: Sri Lanka's Maritime Zone up to EEZ
Source: http://sarcontacts.info/contacts/arcc-Colombo

The prime responsibility of ensuring maritime security of Sri Lanka lies on SLN and for this task SLN has deployed all naval resources with seven Naval Commands (NC) covering the entire Island. The SLN Headquarters Operations Room maintains communication, command and control functions over all NCs as shown below.

With respect of the maritime SAR operations in Colombo SAR region, the overall responsibility lies with Aeronautical Rescue Co-ordination Centre (ARCC) at Ratmalana Airport

and Maritime Rescue Coordination Centre (MRCC)which is located at SLN Headquarters Colombo. The ARCC is the regulatory body of the country's SAR region and MRCC works as the operational body of responding to SAR situation.

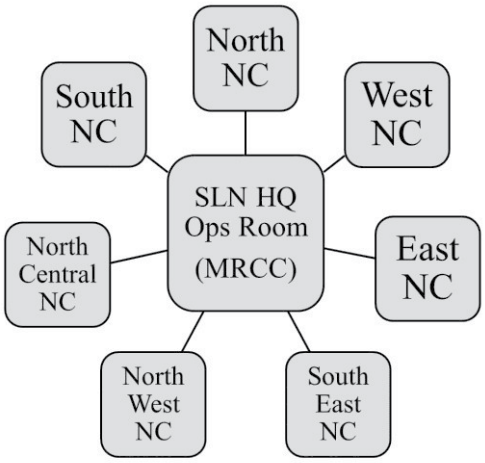


Figure 4: Present SLN maritime security organization

With respect of the maritime SAR operations in Colombo SAR region, the overall responsibility lies with Aeronautical Rescue Co-ordination Centre (ARCC) at Ratmalana Airport and Maritime Rescue Coordination Centre (MRCC)which is located at SLN Headquarters Colombo. The ARCC is the regulatory body of the country's SAR region and MRCC works as the operational body of responding to SAR situation.

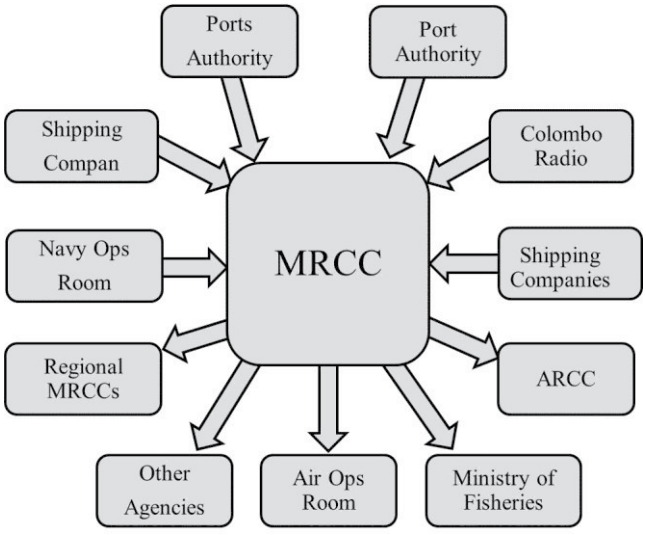


Figure 5: Organization chart of SAR response in Sri Lanka

Presently, maritime security operations are launched and controlled by the SLN Headquarters Operations Room. Also the SAR incidents reported within our SAR region are handled by the MRCC. However, there is no proper integrated system available in receiving or providing SLAF's timely assistance in the country's maritime security spectrum mainly due to lack of coordination between the individual services which results in the degradation in effective command and control.

It is understood that the success of any AMSO or SAR operation depends on the speed with which the operation is planned and carried out. Prompt receipt of all available information by the Air and Naval Operations Rooms, MRCC or ARCC is necessary for thorough evaluation, immediate decision on the best course of action, and a timely activation of available facilities to make it possible to detect, deter, delay and destroy or support in the shortest possible time. It is envisaged that the SLAF Air, RSF and SLN counterparts integrated at a future Maritime Air Organization (MAO) which is empowered in synergistic application of joint service assets, with a clearly laid out chain of command will achieve the objectives of AMSOs.

UNDERSTANDING RSF OPERATIONAL CAPABILITIES AND LIMITATIONS

RSF was established in year 2003 at SLAF Base Hingurakgoda by selecting highly skilled Regiment personnel as a unique group dedicated to protect Air Bases from any form of enemy attack through a robust quick reaction. The RSF are specialized in Air Base Defence (ABD), VVIP, VIP, VA & VP protection, SAR operations, Special Operations etc. The RSF headquarters was initially located at SLAF Base Hingurakgoda due to the fact that the Air Base is centrally located with the facility of helicopter mobility itself for quick reaction in any ABD situation. However, with the escalation of the war situation and expansion of RSF strength, small teams were tactically shifted to other SLAF Stations for any eventuality.

It was learnt that land SAR procedure has been drafted by SLAF in case of an air crash, a natural disaster or any other emergency situation within Sri Lankan land territory where RSF plays a key role. This plan has been proposed and yet to be implemented as an integrated system of RSF and other SLAF agencies located at four air bases (Ratmalana, Anuradapura, Hingurakgoda and Palaly) with organic aircraft facility for SAR on ground. However, the airbase situated closest to the main sea route: SLAF Weerawila has not been selected for this purpose mainly due to the fact that this proposal was focused on land SAR aspects.

The RSF personnel are trained and capable in AMSOs where it can create a vibrant impact in ensuring maritime safety and security. The RSF troops were trained under SLN Special Boat Squadron (SBS) on Basic and Advanced Water Borne Operations, Boat Handling, Diving Operations, Sea Marshalling and Water Survival and Rescue etc. The following RSF capabilities amalgamated with the SLAF air capabilities through a sound plan will be a trailblazer in achieving future prospects of country's maritime security.

Stabilized Tactical Airborne Body Operations (STABO)

Use of an extraction harness which is a device that allows military personnel to be rescued (by helicopter) from field locations, and prevents the conventional landing and boarding of a SLAF RSF troops are well trained on this type of operations.

Special Patrol Insertion/Extraction (SPIE)

This system is developed as a means to rapidly insert and/or extract a reconnaissance patrol from an area that does not permit a helicopter to land. SPIE has application for rough terrain as well as water inserts/extracts. Generally, the SPIE rope is lowered into the pickup area from a hovering helicopter. The helicopter lifts vertically from an extract zone until the rope and personnel are clear of obstructions, then proceeds in forward flight to a secure insert zone. Even though, RSF troops have not done this type of operations practically yet, it's a matter of availability of a special rope for this task.

Combat Rubber Raiding Craft (Rig and Drop Operations)

Also known as the "Combat Rubber Reconnaissance Craft," is a specially fabricated inflatable rubber boat, especially when paddled, lightweight and easily stowed when deflated. This is air transportable and it can be slid out the rear ramp of a helicopter. It is inflatable by foot or CO_2 tank in short time and it can carry 10 passengers with a maximum payload of 2756 lb. RSF troops are well trained on this device and they have performed and experienced on this during the "Ex- Cormorant Strike" with SL Army owned CRRCs and also Flash Style, Balance Style exercise with US Army Special Forces.

Ship Deck Operations

Boarding on to a ship by means of rappelling, fast rope or ladder by lowering oneself from an airborne helicopter by going down a rope hanging from the helicopter; coming down from, or going up to, an airborne helicopter by using a flexible ladder hanging from the helicopter. RSF troops have experienced this operation during the Flash Style and Balance Style exercises conducted by US Army Special Forces.

Although the RSF's focus is primarily on the safety and security of air bases, it is capable of rapidly deploying anywhere in the sea in response to maritime safety and security issue subjected to air transport/ surveillance capabilities. The RSF has counterterrorism capabilities to conduct action against hostile targets in maritime platform to be the first respondents to potential maritime terrorist threats, deny preemptive terrorist actions, and execute security actions against armed hostiles and/or non-compliant threats Airborne SAR etc. Therefore, RSF troops can be utilized to conduct following AMSOs with speed, deterrent and force protection.

- Rapid deployment of troops in prevention of sea piracy, illegal human trafficking, drugs/ arms smuggling and stand–off threats to vital harbours etc.
- Conduct seaborne assault against sea pirates, terrorists.
- Conduct anti highjack ship operations.
- Providing security for maritime economic resources and vital harbours.
- Conduct ASAR operations in order to rescue crew members with serious sickness, fire on board, loss of communication, collision and capsised vessells etc.
- To conduct combat/reconnaissance airborne Patrols to ensure continuous maritime area domination and seize opportunity targets.

LIMITATIONS

The RSF troops also have following limitations in conducting full scale AMSO or any other seaborne operation at Sri Lankan SAR Region.

- Lesser number of troops trained on seaborne, sea survival, anti- hijacking ship and life saving due to lack of training courses and slots offered by SLN.
- Lack of training facility, infrastructure and sophisticated equipment for conducting AMSO at RSF training centre.
- Not getting a chance to do refresher training on seaborne operations with SBS SLN.
- Lesser opportunities in conducting joint training or operations with SLN.
- Lack of knowledge on Law of Sea and other international maritime conventions.
- More training is required to operate in deep sea areas as there is a possibility that RSF troops might face into the spatial disorientation during AMSO.
- Present SAR proposal for land SAR situation has not focused on the AMSO at sea where RSF and Air components are ready only for land SAR.
- Troops have to use some improvised methods due to non-availability of dedicated helicopter for AMSO..
- Ex: For fast roping operations some helicopters do not have a required structure and troops use an improvised method.

UNDERSTANDING SLAF AIR CAPABILITIES AND LIMITATIONS

Fixed-wing aircraft may drop equipment to survivors and direct rescue facilities. They can mark the position as long as they can remain on-scene, through a radio and radar beacon, showing lights, dropping flares, and providing radio signals for direction finding and homing by other rescue facilities.

Helicopters can be used to conduct AMSOs such as STABO, SPIE, Rig and Drop, Rappelling, Winching or landing on a ship if a suitable location exists. Due to their unique flying capabilities, they should be used whenever possible. They are particularly suitable for rescues in heavy seas or at locations where surface facilities are unable to operate.

In responding to any location in our maritime area an assessment to be made on the capabilities and limitations of available SLAF air assets. The following type of SLAF aircraft can be effectively used and the speed, reach, accuracy and timely response are the main advantageous of use of aircraft in AMSOs.

It is observed that the SLAF Mi-17 and Bell 212 helicopters are the most versatile aircraft because: their speed and ability to hover make them suitable for AMSOs up to a limit of 100 NM. They help to conduct AMSOs/ASAR from inaccessible places and rough seas long before surface units can arrive. Helicopters should be equipped with rescue equipment for the evacuation of survivors, e.g. winching equipment, slings, baskets. The RSF troops are more confident and trained in operating from the above helicopters in AMSOs.

Type	Remarks	
Helicopter MI-17	Endurance Range	0230 Hrs 120 NM
B -212	Endurance Range	0230 Hrs 110 NM
Fix Wing AN-32	Endurance Range	0420 Hrs 400 NM
C-130	Endurance Range	0800 Hrs 850 NM
B 200	Endurance Range	0600 Hrs 400NM
Y-12	Endurance Range	0430 Hrs 200 NM

Table 2: SLAF air capabilities

LIMITATIONS

Each aircraft has operational and technical limitations and should not be used on operations for which it is not suitable. When possible, an AMSO by aircraft should be backed up by a surface facility, particularly for a large number of survivors during a SAR mission.However, in an emergency, flight safety is the primary consideration. The following limitations are found with respect of SLAF aircraft in attending AMSO at sea.

- The less endurance is found as the major limitations with the SLAF aircraft when covering the country's large SAR region. The SE edge of the FIR is located 780 NM from the country and EEZ is 200 NM from the shore.
- Example: A Mi-17 helicopter takes off from an airbase closest to sea at a speed of 100 KTS can reach only 100 NM in the sea including a 30 minutes loitering time.
- Available SLAF aircraft are less equipped with proper ASAR gear.
- The number of RSF troops and survivors that a helicopter may take aboard each trip is limited. Therefore, it may be necessary to reduce its weight by removal of non-essential equipment or fuel. Fuel loads at the scene may be reduced by use of advance bases with fuelling capabilities.
- Limited radar coverage provided by the SLAF and Civil Aviation Authority Radar at Pidurutalagala which covers up to 250 NM also a hindrance in navigating SLAF aircraft for SAR operations.
- Limited capabilities in conducting AMSOs in night time and under bad weather conditions.
- Higher vulnerability of RSF troops and pilots operate in high seas to get caught into spatial disorientation condition described in aviation medicine.
- Non availability of a dedicated integrated platform at Naval and AFHQ levels and helicopter deployment with RSF troops at SLAF Weerawila.

UNDERSTANDING SLN CAPABILITIES AND LIMITATIONS

In responding to any maritime security or SAR event in Sri Lankan SAR region, SLN is the focal point in coordinating and arranging such facility based on their naval capabilities. The experience and knowledge of SBS personnel on seaborne operations and high endurance and capacity of SLN ships to cater a large amount of casualties in a SAR situation are the advantages with the SLN. The following table explains capabilities of some of the SLN craft dedicated to be utilized for maritime security.

Facilities	Remarks
Off Shore Petrol Vessels (OPV)	Could carry 450 casualties Speed :21 KTS Range :5800NM at 15KTS
Fast Missile Vessel (FMV)	Could carry 70 casualties. Speed :32 KTS Range :1650 NM at 30 KTS :4000 NM at 17.5 KTS
Fast Gun Boat (FGB)	Could carry 20 casualties Speed :28 KTS Range :750 NM at 16 KTS
Support/Training Ship (AA/AX)	Could carry 300 casualties Speed :10 KTS Range :5500 NM at 09 KTS
Landing Ship Tanker (LST).	Could carry 300 casualties Speed :14 KTS Range :1000 NM at 12 KTS

Table 2: SLN Naval ship capabilities

LIMITATIONS

It was found that the following limitations are found with respect to SLN in attending SAR situation at sea.

- Lower speed of naval craft in responding to
- maritime security/SAR situations.
- An uncertain feeling amongst MRCC Naval personnel on SLAF response and assistance on ASAR situation due to long administrative process to take off an aircraft.
- Non availability of a dedicated joint maritime security platform with air capability for immediate respond for any type of maritime threat /challenge.
- The maximum range of radar deployed on SLN coastal establishments is not more than 40 NM.
- Lack of awareness of SLN personnel about SLAF Air and RSF capabilities in AMSOs.

COMPARISON OF FORCES IN RESPONSE TO AMSOS

As far as the capabilities and limitations of SLAF and SLN are concerned one can clearly understand about the SLAF overriding strengths in terms of speed, reach and height in AMSO situations in maritime domain. The RSF troops can effectively exploit this potential in combined with their Naval Elite Forces with a vibrant plan to accomplish most expected objectives of combined maritime security operation.

The following example obviously shows the Mi-17 helicopter's superseding capabilities over SLN Fast Gun Boat (FGB) in terms of speed, time and reach.

SLN	SLAF
Can cover FIR with high endurance	SLAF aircraft cannot cover total FIR, EEZ due to low endurance.
	RSF is capable in attending any of the following SAR situations provided within SLAF Air capabilities: - Vessel collision - Vessel on fire - Vessel capsized or sinking - Persons in the water - Serious injury or sick - Technical failures
	RSF is capable of conducting STABO, Special Patrol Insertion/Extraction, Combat Rubber Raiding Craft and Ship Deck Operations
Can cover FIR with low speed	- Can cover a maximum ROA of 100NM with high speed by Mi-17 Helicopter with above RSF capabilities - Maximum ROA with speed by C-130 upto 400NM
Can cover FIR with higher number of rescued on board	Only limited casualties can be rescued
Difficult to conduct incident surveillance	Fast and accurate incident surveillance capabilities
Can operate in Night	Difficult to operate in night
Can operate easily up to Sea State-III	Cannot operate under bad weather conditions
Troops are highly orientated to the sea conditions	Survivability of RSF troops to be increased with more realistic sea training

Table 3: Comparison of forces

Type of AC/ Ship	Cruising Speed	Distance to Target	Time
Mi-17	130 Kts	100 NM	46 Min
FGB	28 Kts	100 NM	3 Hrs 56 Min

Table 4: Comparison of SLAF Mi-17 and SLN FGB

ESTABLISHMENT OF AMSO SUB-REGIONS

As far as the above capabilities and limitations of SLAF Air, RSF and SLN are concerned it is proposed to establish four AMSO Sub-regions considering the maximum Radius of Action of Mi- 17 helicopter. The present SLAF land SAR plan can be extended into AMSO platform additionally establishing an AMSO unit at SLAF Weerawila, which being closer to the main international sea route.

- AMSO- A at SLAF Base Ratmalana
- AMSO- B at SLAF Weerawila
- AMSO- C at SLAF Academy China Bay
- AMSO- D at SLAF Palaly

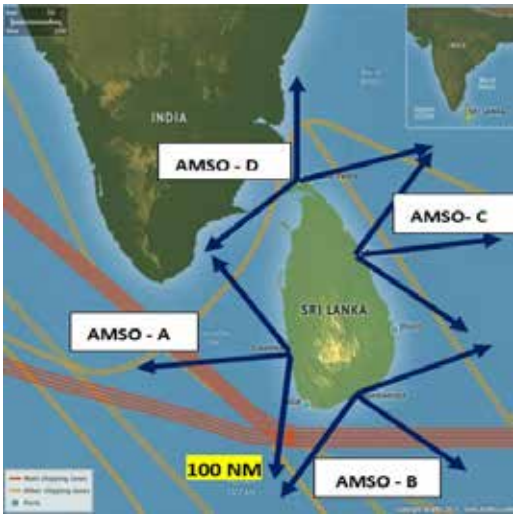


Figure 6: Locations of proposed AMSO Sub-regions

Establishment of the above AMSO Sub-regions will be effectively utilized to exploit the AMSO needs of hundreds of commercial ships sailing closer to these areas. It can be done by delivering of RSF personnel and equipment and also these AMSO Sub-regions are reliable means of delivering supplies, equipment, and personnel to the scene of a distress.

All AMSOs conduct in the proposed regions to be done jointly with the SLN SBS to avoid fratricide or other operational issues. The proposed complement of SLAF Air, RSF and SLN components to be deployed at an AMSO is as follows.

SLAF AIR	RSF	SLN- SBS
- One or Two Mi-17/Bell 212 -UAV or Beach King	02 or 03 eight man teams	01 or 02 four man teams

Table 5: Proposed composition of AMSO sub-region

EXTENDING SLAF AMSO & MAO PROPOSALS FOR NATION BUILDING EFFORT

The above mentioned AMSO Sub-regions coordinated and amalgamated through the proposed MAO can be optimally utilized by projecting an aggressive domination within the area where RSF troops can easily operate. The confidence built up amongst the large number of frequent users of our sea area will be a great avenue in achieving the competitive advantage in establishing the country's image in international arena as a responsible island nation.

It is also understood that the Sri Lanka's developing oceanic recreational opportunities such as whale and dolphin watching, surfing, deep sea diving and other sea sports will increase the demand for AMSO such as conducting ASAR operations. The oil and natural gas exploration activities at Cauvery and Mannar basins is also another activity that will have future demand for AMSO.

This proposed AMSO Sub-regional concept and establishment of fully fledge MAO in Sri Lanka will certainly bolster the maritime operational capabilities of SLN and SLAF. This joint maritime operational platform will be an attractive package in terms of reducing the huge sum of money spent on insurance cover by commercial shipping lines. This can lead to improve public confidence in that State's reputation and commitment to providing a safe environment, leading to increased confidence, decreased insurance premium to conduct activities indirectly beneficial to State's economy.

There are one hundred thirty two (132) shipping line agents and Twenty Nine (29) maritime security agencies operating from Sri Lankan soil and most of them carryout Off-Port Limit (OPL) services: carrying out essential supply services based from a main Port for offshore ships within a normal range of 12 NM limits which include followings services. It is worthy to mention that upon establishing a formidable MASO and MAO there is a possibility to provide SLAF air and RSF assistance to conduct OPL services above 12 NM range to all interested parties.

- Crew changes
- Emergency evacuation of accident / sick crew members
- Embarking/dis-embarking superintendents / Sea Marshals/ Inspectors / surveyors etc.
- Embarking of repair teams / riding squads
- Transfer of spares / equipment
- Many other support services needed by vessels

The speed, time, money and the colossal amount of risk involved with the OPL services are of concern and the proposed AMOS and MAO can selectively extend its services to these government and non government ship operators/security agencies by conducting extreme difficult and very urgent OPL services. In this backdrop, availability of this type of maritime contingency service package is a positive and essential measure for Sri Lanka to the way forward.

The proposed joint combat/reconnaissance airborne helicopter patrols under UAV or Beachcraft surveillance cover can act as a force multiplier to the present naval craft deployments in high risk areas. In this passage, it is worthy to study how SLAF Air and RSF capabilities can be utilized to address the limitations and enhance the capabilities of naval craft such as reaction time, detection and strike power etc.

Example: Sri Lanka's South of Mannar maritime region is highly susceptible for drug, arms & commercial goods smuggling, illegal entrants etc In order to curb this, SLN conducts routine surveillance operation in this area by sending OPVs/FGBs from Colombo to Mannar area for 3 -5 days period. The SLAF can offer following assistance to SLN's effort in following manner.

- By providing air surveillance cover and directing naval craft to enhance the detection range.
- By deploying quick reaction airborne teams to required locations when noticed by SLN or SLAF surveillance craft.
- By offering ASAR assistance to any emergency in the region.

However the above proposal is subjected to the specific limitations of SLAF Air and RSF components such as training, technology, weather, night operability, range etc. discussed earlier. It is further found out that the Sri Lankan fishing community who operate trawlers in the EEZ are also

another segment that be benefitted from this proposal in which they can request ASAR through MRCC of the MAO.

FINDINGS

The findings of the research are based on the primary and secondary information gathered and analysed with relevant to the SLAF Air, RSF and SLN capabilities/weaknesses in conducting AMSOs in Air and Maritime perspectives.

- SLAF aircraft combined with RSF troops on AMSOs can be deployed in response of any maritime security eventuality up to a limited extent in the Sri Lankan maritime domain.
- SLAF has to provide sophisticated and mission essential AMSO, ASAR equipment and joint training at deep seas to provide an effective and efficient service in terms of speed, reach and accuracy with RSF troops.
- RSF capabilities in AMSOs with joint participation of SBS troops can be used to show nation's maritime domination ability in maritime security aspects by assuring quick response, timely availability, domination, trust and responsibility.
- SLAF needs to acquire modern aircraft dedicated for AMSO/ ASAR operations to increase the reach, domination and quick response.
- There is no integrated MAO to command, control, co-ordinate and communicate all AMSOs within Sri Lankan SAR region.
- There is a possibility that the above mentioned AMSO Sub-regions coordinated and amalgamated through the proposed MAO will be a great avenue in achieving the competitive advantage in establishing the country's image in international arena as a responsible island nation.
- The proposed AMSO Sub-regional concept and MAO in Sri Lanka will certainly bolster the joint maritime operational capabilities of SLN and SLAF. This can lead to improve operational efficiency of SLN's present maritime operations and to gain public confidence in country's reputation and commitment to providing a safe maritime environment.
- SLAF can extend its AMSO capabilities by providing selected OPL services to shipping agents/security agencies where the they face limitations in terms of time, speed, range and cost. Availability of this type of maritime contingency service package is a positive and essential measure for Sri Lanka to way forward.
- There is an understanding that the SLAF has great potentiality to utilize its Air and RSF capabilities jointly with SBS to address the limitations and enhance the capabilities of naval craft such as reaction time, detection and strike power etc.
- The SLAF proposal for SAR over land has not considered locating a team at SLAF Weerawila where it could have more reach and speed to any AMOSs/ ASAR at main international sea route.
- RSF troops have a great potential in providing its ASAR facilities to maritime recreation and sea sports developments in the country with the increase demand for more speedy and timely ASAR as well as to oil and natural gas exploration activities at Cauvery & Mannar Basins in future.

The recommendations of the research are based on the findings made above and it is envisaged that the SLAF may perform better in all AMSOs by exploiting its full potential of Air and RSF capabilities in Air and Maritime perspectives.

- To develop SLAF Air, RSF capabilities matching with current maritime security challenges/ opportunities for utilizing the unique AMSO capabilities of RSF mixed with SLAF air component as an influential maritime area domination tool in Sri Lankan sea.
- To provide high tech, sophisticated mission essential AMSO/ SAR equipment and more joint training facilities in deep sea operations for RSF troops to develop skills, efficiency, courage, perseverance and most importantly their morale.
- To conduct awareness programme to SLAF and SLN personnel to develop mutual understanding, coordination and understanding about strengths and weaknesses of SLAF and SLN on AMSO/ SAR operations.
- To conduct awareness training programme for RSF troops on Law of Sea and other conventions on maritime security operations at sea.
- To develop and extend the proposed SAR procedure over land in to AMSO/ASAR in sea area by developing AMSO Sub-regions, enabling RSF and SBS troops to contribute with their capabilities to ensure maritime interests by identifying SLAF Weeerawila as an operational platform.

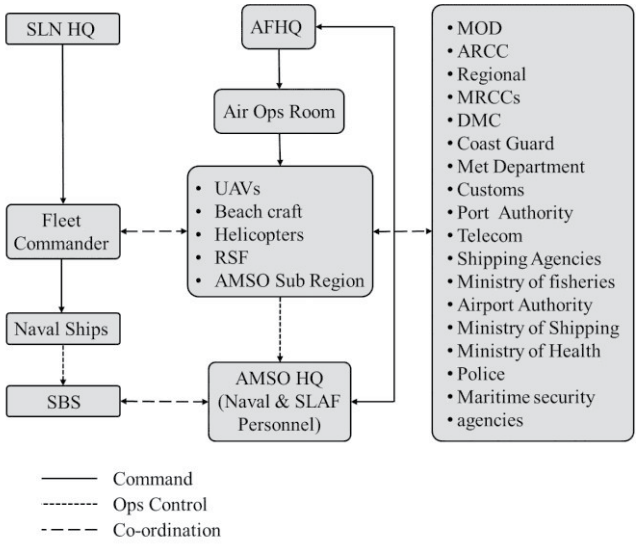


Diagram 5: Proposed MAO for Sri Lanka

- To propose a maritime contingency service package to provide selected OPL services to all shipping line agents, security agencies and interested bodies such as fisheries ministry, port authority, foreign missions etc. To ensure a safe and secure passage for legitimate users of our sea this will benefit the entire world.
- To provide ASAR services to maritime recreation and sea sports developments as well as to oil and natural gas exploration activities at Cauvery & Mannar Basins.

- To provide equal training and communication facilities to RSF and SBS personnel to make joint operations more productive.
- Having understood the present maritime security situation of the country and non availability of a dedicated MAO, a sound plan is necessary to address the issues discussed earlier. A dedicated MAO is proposed to link both civil and military authorities and function as the administrative body of AMSO/SAR management and coordination in accordance with international standards.

CONCLUSION

As a nation, Sri Lanka has always looked out into the wider world to shape and influence international events. This strategy explains how we organize and use our current national capabilities to identify, assess and address maritime security issues at home and overseas, and how we intend to improve our ability to do so in future through the most efficient use of available resources. As a maritime nation, Sri Lanka relies on the safe, secure and free flow of legitimate global agencies through her ports and waterways. However, those who threaten national interests also use the maritime environment for illegitimate activity. The threat of deliberate illegitimate activities, coupled with inevitable accidents and natural disasters, demands the SLAF and SLN to maintain a persistent presence in the maritime domain.

It is clear that individual military arms acting in isolation will not be able to effect lasting practical solutions for any of these major issues. Without the sharing of intelligence and vital information, and proper communication and coordination of air and naval operations, individual service will not be able to address these properly. It is of paramount importance to develop our capabilities and linkages to work in an integrated air- maritime platform within the Sri Lankan maritime region for the common good of our people.

Inevitably, SLAF will be an active partner in the maritime security cooperation in country's maritime domain, especially due to the vital air capabilities, strategically located airbases and more importantly the presence of highly skilled, dedicated elite force geared up to take up AMSOs in sea or land. Greater cooperation and partnership between the SLAF and SL naval powers in AMSOs will be a great opportunity to ensure aggressive domination in the sea as a maritime nation, ensuring a safe and secure passage for legitimate users of our sea which will benefit the entire world, and enable all of us to face the future with confidence.

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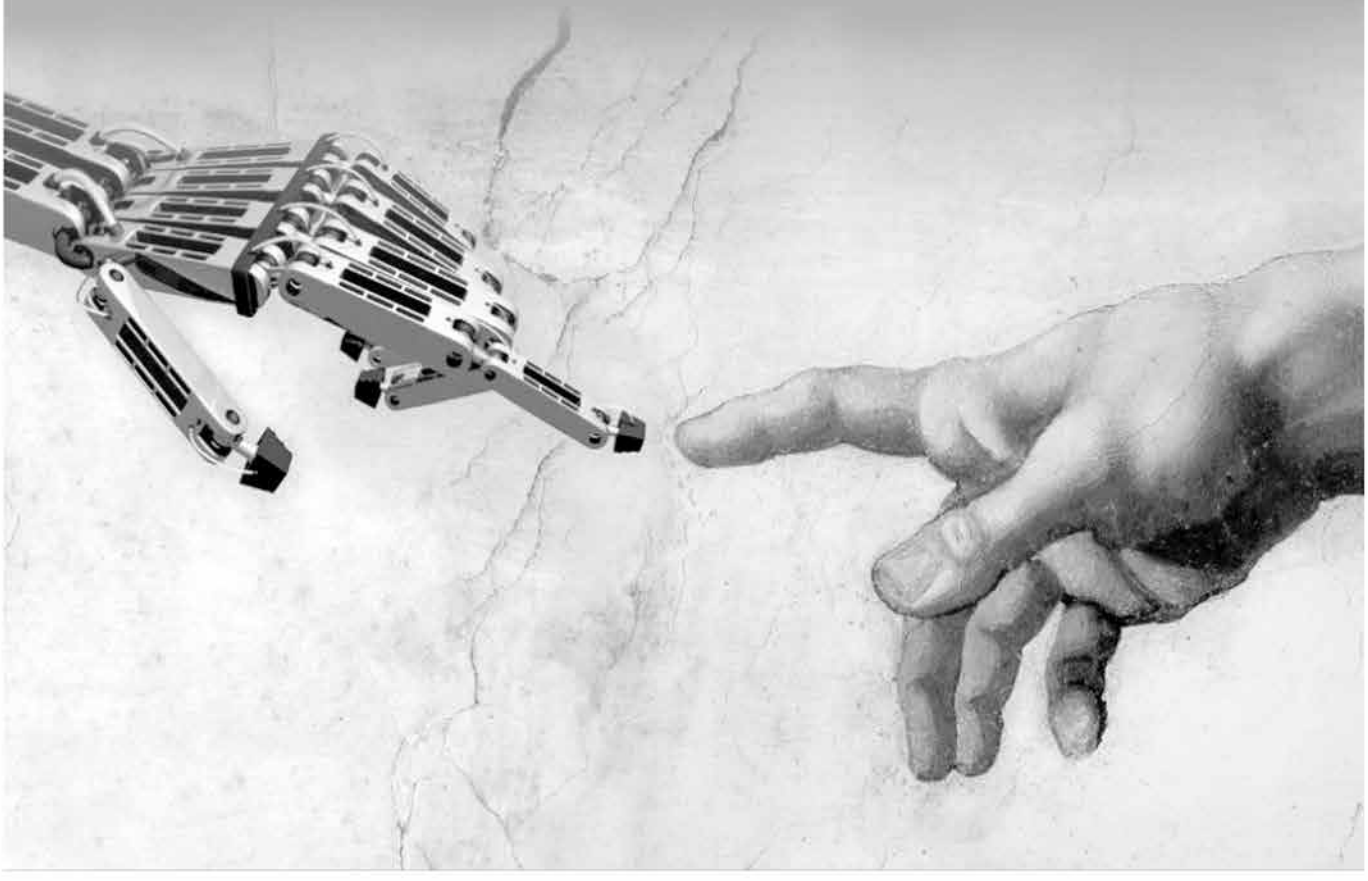
Maritime Air Cognition



SPATIAL DISORIENTATION AS AN AERO MEDICAL CONCERN IN ROTOR WING MARITIME OPERATIONS OF SRI LANKA AIR FORCE

By
Flight Lieutenant SCB Madurawala MBBS (Sri Lanka)

Abstract - Maritime Air operations are an integral part in the security of Sri Lanka. The effectiveness of the Maritime Air surveillance and other operations were highlighted specially during the final stage of the Humanitarian mission. This contribution continued into the post war era and it has directly and indirectly supported the Nation building during the post – war era of Sri Lanka.

Spatial disorientation (SD) is the main Aero medical concern of maritime flying. Proper knowledge and training on spatial disorientation will help the aviators in preventing air mishaps during Maritime operations.

The objective of this study is to assess the knowledge and training on spatial disorientation (SD) together with tendency to share or report the incidents with their fellow aviators of Sri Lanka Air Force. The study also assessed the tendency for a pilot to fly despite being fatigued as it's a major risk factor for spatial disorientation. The study sample consisted of 20 SLAF rotor wing pilots with more than 500 hours of flying experience. Data were collected using a standard questionnaire.

The study found that there are lapses in simulator training as only 35% of pilots in the study have undergone simulator training involving SD. 75% of pilots in the study sample had experienced SD but only 40% of the pilots who had experienced SD in actual scenarios have shared their knowledge with fellow aviators. This while highlighting the vast experience and versatility of our aviators also highlights lapses in the experience sharing process. Further 85% of pilots involved have flown operational flights despite being fatigued.

The study recommends to initiate routine lectures on aero medical aspects of SD and to arrange routine simulator training on SD for pilots. It also suggests publishing a news bulletin or a magazine to share SD and related flying experiences with other pilots.

Key Words - Maritime operations, Aero medical concerns, Spatial disorientation, Fatigue

INTRODUCTION

Sri Lanka being an island has a coast line of 1585km and has an exclusive economic zone (EEC) sea area of 598229km which is more than 9 times of its land area. (United Nations Convention on the Law of the Sea, 1982) The Colombo Flight Information Region (FIR), is approximately 97500 square kilometers of sea area. This is more than the land area of the island. (Airport and aviation services Sri Lanka 2011 and 2009). Therefore the operational area for air operations over water is extremely high compared to the land area of the island. With the expectant increase in the size of EEC to more than 23 times of the land area, this requirement is further expected to increase (Wijerathne, A., 2007).

With the cessation of terrorist war, Sri Lanka is becoming an international hub of maritime and aviation activities. Growing number of such activities in the waters around the island is presenting new challenges to the Sri Lanka Air Force (SLAF). These include Search and rescue (SIR) operations in the FIR region and maritime surveillance operations in addition to requirement of maintaining offensive capabilities at sea. Furthermore, with the recent initiatives to dig oil in the Mannar Basin the requirement of maritime air operations are expected to increase exponentially in the near future. Therefore the SLAF responsibility in providing effective maritime security is of utmost importance to developing Sri Lanka.

During the era of terrorist war, though there was a significant input from the Air Force in maritime defense, majority of operations were carried out close to the shore. Further with some of the experienced pilots moving away from active flying operations, it is necessary asses the capabilities of current operational SLAF aviators in executing maritime operations and to arrange proper training prior to engaging in such operations.

Human physiology is developed for functions on ground. Human senses are organized to gather and process data in relation to gravitational forces of earth. Therefore flying presents the aviator with a range of medical issues which are not experienced in ground. Flying over water augments these issues.

The main aero medical issue of concern which contributes to fatal accidents when flying over water is spatial disorientation. *(Belland K, 2013)*

Spatial Disorientation (SD)

Humans orient themselves in relation to the plane of earth's surface and the gravitational vertical. This is a subconscious process done with the help of visual system, vestibular organs in the inner ear and pressure sensors in the body. Out of these three senses, humans rely mainly on the visual system to determine its orientation.

During flight, accurate perception of aircraft orientation mainly depends on visual cues. (*Benson, A.J, 2006)*. Maritime environments lack proper visual cues and this is more pronounced in bad weather conditions and during night flying.

In the complex environment of flight, aviator may be exposed to contradicting information from these senses leading to spatial disorientation. According to Benson and Scott (2006), "Spatial disorientation is a term used to describe variety of incidents occurring in flight wherein an aviator fails to sense correctly, his motion, position and attitude within the fixed coordinate system provided by the surface of earth and the gravitational vertical. In addition the errors of perception by the aviator, of his position, motion, or attitude with respect to their aircraft, or of their own aircraft related to other aircraft". (Benson and Stott 2006) In simpler terms it can be stated as inability to say which way is up. (FAA, 1983)

Spatial disorientation is a well-documented cause of aircraft accidents. Lyons, T et al (2006) analyzed aircraft accidents of United State Air Force (USAF) from year 1990 to 2004 and concluded that 11% of crashes are due to SD with 69% crash fatality rate. Another study involving US army rotary wing operations by Braithwaite M,G, et al (1998) reported that 30% of aircraft accidents are due to SD and 78% of aircrew had been disoriented during their career. (Braithwaite M,G, et al.1998). The role of spatial disorientation in aviation accidents is further reinforced by a study analyzing US army rotary wing accidents from 2002 to 2011 which concludes that 11% of all US army rotor wing accidents are due to spatial disorientation. (Gaydos et al. 2012)

In maritime environment aviators are more prone to disorientation as there are no proper visual cues in the sea. Further the sky water interface makes it difficult to identify the horizon. Sea is famous for its high volatility and sudden changes in weather which further impair visibility. During night time, the presence of ships and fishing boats may give a false perception of stars, disorienting the aviator. Therefore spatial disorientation is a major concern in maritime operations.

Disorientation of an aviator can be categorized as following,

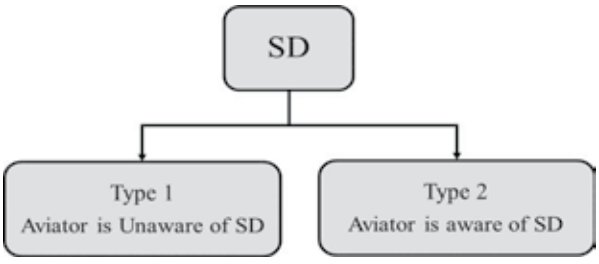


Figure 1: Types of SD
(Benson, A.J. and Stott, J.R.R., 2006)

The main concern in aviation is converting type one SD into type two SD. This requires training of pilots especially in simulated environments such as flight simulators to make them feel what spatial disorientation is about. Further sharing of knowledge between pilots about their experience on SD would educate others on the prevalence of SD and also on the corrective actions which the victim of SD, did at the time of disorientation to break out of the disorientation. This would help fellow aviators in making the right decision at the time of disorientation and to avoid SD prone situations such as flying when fatigued or when in bad health.

PROBLEM STATEMENT

Flying over sea exposes aviators with increased risk of spatial disorientation. Therefore engaging in maritime operations requires greater degree of understanding on SD and proper training.

Sri Lanka Air force possess a highly trained and versatile group of aviators who are with an immense degree of flying experience in war related hostile environment. But it is necessary to assess their knowledge and training on maritime flying hazards and to train them prior to engage in such missions.

No such assessment on aero medical concerns associated with flying in SLAF has been done up to date. Therefore it is pertinent to conduct a survey and recommend necessary actions to make the skies over ocean safer for SLAF pilots.

OBJECTIVE OF THE STUDY

The objectives of the study were,

- Asses the knowledge and frequency of training on SD for SLAF rotor wing pilots
- Asses the occurrence of Spatial disorientation in SLAF rotor wing pilots
- Asses the tendency to fly when fatigued

METHODOLOGY

Data were gathered using a questioner and by direct interviews of pilots from 04 squadron, 06 squadron, 07 squadron and 09 squadron of SLAF.

Inclusion criteria

- Rotor Pilots with more than 500 flying hours
- Pilots should be involved in active flying duties of SLAF at the time of survey

Exclusion criteria

- Pilots who are grounded for a period of more than one year due to medical or any other reason.
- Pilots who are permanently on medical standards below A_3G_1.
- Pilots who did not give consent for the study

An extensive literature review was done prior to the study to assess the global trends in aero medical aspects of spatial disorientation and fatigue as well as its relationship to maritime flying.

DATA ANALYSIS AND FINDINGS

25 Percentage of the pilots involved in the study have not had any refreshment on aero medical aspects of SD after ground school and 45% has not had any teaching within last five years.

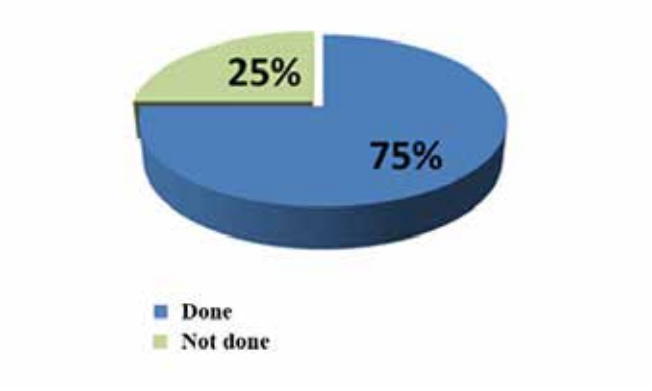


Figure 2: Teaching on SD after ground school

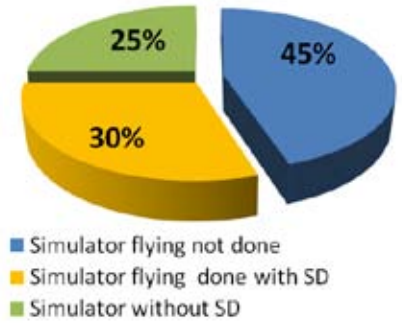


Figure 3: Simulator training for pilots

55 Percentage of the pilots involved in the study have undergone simulator training but only 25% have done simulator training which included training in SD.

75 Percentage of pilots involved in the study confirmed that they have experienced SD in flight and all of them except for one have handed over the control to their co-pilot.

Criteria	Number	Percentage
Pilots experienced SD	15	75%
SD in Maritime environment	05	25%
Discussed their experience with other pilots	6	40%

Table 1:. Occurrence and reporting of SD

40 Percentage of pilots confirmed that they have discussed about their experience of SD after the incident at their squadrons in an informal setting. But except for one pilot all concurred that they have not discussed the issues in a formal setting nor documented their experience.

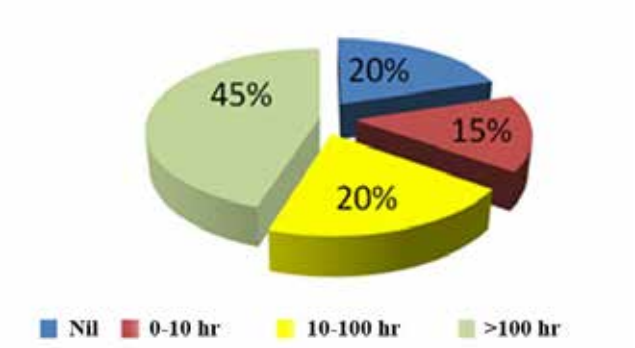


Figure 4: Number of maritime flying hours among SLAF Rotor

80 Percentage of pilots have experience on maritime flying. This showcases the vast experience of SLAF pilots.

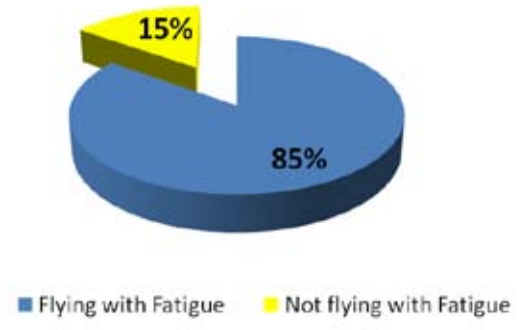


Figure 5: Flying and associated Fatigue

DISCUSSION

This study concentrated on the knowledge and training on spatial disorientation and their knowledge on fatigue in a cohort of SLAF rotor pilots.

The study highlights that more than one fourth of pilots involved in the study haven't had timely refreshment in their knowledge on aero medical aspects of spatial disorientation. A knowledge on spatial disorientation helps to identify occurrence of spatial disorientation and convert 'type 1' spatial disorientation to 'type 2' spatial disorientation and take corrective actions early. Action is needed to impart lectures on spatial disorientation to continuous training programme for pilots with the active participation from aviation medicine qualified medical officers in the organization.

The study included pilots with over 500 hours of flying experience and 75 percent of pilots had over 1000 hours of experience. All pilots have been in the service for more than 5 years. But it was highlighted that only 55% of pilots in the

study have engaged in simulator flying in their career and out of them only 60 percentage have engaged in simulator training involving spatial disorientation and illusions. Therefore only 35 percent of pilots involved in the study have engaged in simulator flying involving spatial disorientation. The Federal Aviation Administration (FDA) suggests that prior exposure to simulated illusions would help in prevention of SD (FDA Pilot safety brochures). Therefore it is pertinent to expose all SLAF pilots to simulator training prior to engaging in maritime operations in the future. Further these simulator training sessions should include training on spatial disorientations and simulated maritime environments.

75 percentage of the pilots stated that they have experienced spatial disorientation in their flying career. This confers to the findings of the study done by Braithwaiteetal involving United State army rotor wing pilots in 1998 where 78% of pilots involved had experienced SD in their flying carrier. *(Braithwaite et al. 1998)*.

The interview with pilots revealed that that they are afraid to discuss their experience in spatial disorientation due to fear of litigation and also due to the belief that spatial disorientation is a phenomenon which should not occur to an experienced pilot. This could also be due to lapses in education on SD. Sharing of experience make other pilots more prepared for spatial disorientation scenarios in the future *(Newman. 2007*).

Almost all pilots involved in the study stated that he was the senior pilot at time of disorientation and handed over the controls to his junior co-pilot when they felt that they are disoriented as they could remember their training on spatial disorientation. But one pilot stated that he did not hand over the control to his co-pilot thinking that he too could be disoriented due to lack of experience. This attitude may be due to lack of proper training on SD. The literature on the subject clearly a emphasize that the possibility of both pilots could be disoriented at the same time is very rare and most of the time it is the most experienced pilot who get disoriented. Further, experienced pilot being the victim of disorientation in all incidents reported in the study, concurs with finding of the study by Lyons. *(Lyons et al. 1994).*

Out of the study population, 80% of pilots have experience in maritime flying. Out of these, 25 percent had experienced spatial disorientation in maritime environment and almost all stated that they had difficulty in orientation at night especially due to lights from fishing boats.

Almost all pilots involved in the study stated that they will continue fly despite being fatigued

Involving pilots from Jet Squadrons and Fixed wing transport squadrons for the study would help in comparison of data on the occurrence of spatial disorientation between different groups of aviators as demands are different in each of these groups. A more extensive study is needed to understand the true gravity of problems faced by aviators of SLAF in operations over maritime environment. The issues could be more pronounced in single crew aircrafts especially among jet pilots.

While playing attention to the development of personnel skills of the pilots, attention should be drawn toward the capabilities of current aircraft fleet. Aircrafts needs to be upgraded with features such as Head up display (HUD) and autopilot capabilities which would minimize the risks of spatial disorientation as well as pilot fatigue during maritime operations.

This study provides a foundation into further research in aero medical constraints associated with maritime flying.

RECOMMENDATIONS

Based on the findings the study recommends the following.

- Lectures on spatial disorientation should be arranged with liaison with aviation medicine qualified medical officers at least biannually in all flying squadrons. This occasion can also be utilized as a platform to discuss and share experience on spatial disorientation with fellow aviators.

- Simulator flying training should be given for all SLAF pilots at least once in two years and effort should be taken to ensure that the training programme involve simulation of disorientation scenarios. The training sessions should be organized to follow a pre-planned syllabus to ensure that all pilots have a similar and comprehensive simulator training experience. Further with expected increase in maritime operations the simulator training should be arranged to include scenarios of offshore operations such as deck landings for helicopter pilots.

- A method should be devised to publish the experience of pilots regarding spatial disorientation and other incidents. This could be in the form of a news bulletin. This would provide information to a broader segment of aviators in SLAF. Further, Flight safety conference should have a segment where the pilots would describe their experiences in operational flying.

- Proper education on fatigue and its adverse effects should be imparted on all aircrew and fatigue management strategies such as powernaps should be encouraged.

- Current fleet of aircraft needs to be upgraded with features such as Head up display and autopilot capabilities to minimize the risk of spatial disorientation and to aid the pilot in breaking free from SD situations. These capabilities should be considered when procuring new aircrafts to SLAF in the future.

CONCLUSION

Spatial disorientation is the main aeromedical concern in maritime flying. Proper training on pilots on spatial disorientation and upgrading the fleet of aircraft with SD minimizing aids such as autopilot capabilities would have a positive impact on the maritime air operation of SLAF and thereby would aid in its responsibility in driving the Nation to prosperity.

ACKNOWLEDGEMENT

The support given by pilots of all rotor wing flying formations who volunteered to involve in the study are greatly acknowledged.

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THE NEXUS BETWEEN ARTIFICIAL INTELLIGENCE AND MILITARY COGNITION – A DIRE REQUIREMENT OF RESTRUCTURING SRI LANKA AIR FORCE IN ENSURING MARITIME AIR SECURITY

By
Squadron Leader KGLK Kapugama RWP, RSP, BSc (Def Stu)

Abstract- Studies that carried out in to the future existence of human beings and machine learning terrified the writer in many aspects. The existing knowledge of human beings can be utilized to enhance the quality of life while the same can be integrated with Sri Lankan military to preserve the National Security. At present, human activities are being replaced by machines with the advancement of technology. In this paper the writer attempts to elaborate the requirement of an imminent restructuring process of Sri Lanka Air Force in Nation Building.

In this paper the researcher intends to emphasize the importance of restructuring the existing Air Force air traffic controlling system to suit future challenges. In that he explains the impact of Artificial Intelligence on future human existence in days to come. Herethe writer explains the automation of intelligent artefacts and the intelligent behaviour of such programmes especially the tools for reasoning and problem solving to aid the existing reconnaissance and fighter controlling system. The researcher elaborates the automated information gathering and analysing system to be used in exclusive economic zone. The researcher intends to stress the possible future challenges to Air Force and he further emphasizes the new epoch of human evolution along with a novel requirement in amended system. With the help of literature available on human knowledge the researcher determines to explain the requirement of speedy action in machine and human reconciliation. The research is mainly based on the conceptual and empirical scientific data; the research was designed with a theoretical framework to identify the dimensions in conceptualizing the psychological world to the real world. The researcher utilized the stratified sampling technique and ordinal and nominal scaling techniques in data collection. Primary data have been collected through interviews and discussions.

The objective of the study is to determine future challenges to the existing system and its uncertainty in the dynamic world and to analyse the potential of employing AI in maritime security.

The researcher explains systems to understand or represent types of knowledge which includes rules and arguments and then how to reason with them with manipulate precedents, to apply and inference with rules and tailor arguments to facts. The writer recommends to amalgamate AI in system reasoning and to formulate regulations to address future threats. Finally the researcher suggests integrating military air traffic controlling with AI in the Sri Lankan Flight Information Region (FIR). He also suggests the academia to research on this field and to come up with appropriate methodologies in mitigating future risks to the Air Force existence. In furtherance the researcher suggests the Air Force Head Quarters to establish an AI Command for scientific research

Keywords: Artificial Intelligence, Sri Lanka Air Force, National Security

INTRODUCTION

The writers' attention was drawn to a separate new space by a question raised during his presentation on AI in counter Insurgency Operation which was conducted in year 2014 at the International Symposium of Kotalawala Defence University. A spectator raised a question regarding the legal framework for Intelligent Agents in Cyber space. The question that came to the researchers mind is "Who should we penalize and how we should control if intelligent machines start criminal activities without human intervention in Sri Lankan Air Space with the progression of technology? Or can we as an Air Force utilize the same to ensure National Security".In January 2015, a gathering of the world's most renowned scientists and technology entrepreneurs signed an open letter toThe Future of Life Institute warning of the potential dangers that irrational artificial intelligence could bring. The institute cautioned that, while AI has the potential to do well such as eradicating disease and poverty, the risks are often being left unanswered.

In this paper, the writer identified the future threat of machine learning to human kind, and the potential danger in absence of legal framework or mere nonexistence of a proper system to negotiate future threats by machine learning. Also he understood the significance of amalgamation of AI in to the existing system of SLAF in enhancing the human cognition and synchronizing the SLAF with regional forces and emerging threats. Sri Lanka is an island surrounds by the Indian Ocean. The airlines or ships operating to Sri Lanka have a major concern in search and rescue (SAR) operations and maritime security of the country. In an emergency occurs in the Sri Lankan exclusive economic zone (EEZ) the SLAF has a major task in reconnaissance and mission execution. This is directly delegated to the Sri Lankan military. With the existing structure this process is quite challenging, in addressing this lacuna researcher suggests to merge Artificial Intelligence (AI) to SLAF. He suggests amalgamating machine learning in Air Traffic Controlling to enhance the human cognition. In this paper the researcher attempts to emphasize the potential future threats in securing National Interest of the country. Multifaceted elaborations of various existing procedures could address almost all of criminal or civil complications in the world. With the recent advancement of

technology, even protracted systems are likely to be challenged. However, it's true that the human cognition in reasoning or in any other cognitive function could be enhanced with the rational utilization of Artificial Intelligence. In this paper the writer attempts to explain the impact of Artificial Intelligence on future human existence in days to come and importance of restructuring the existing system in SLAF to suit future challenges.

METHODOLOGY

The researcher critically reviewed the conceptual and empirical research documents about the study. Conceptual literature survey suggested an important theory to support the writers' attempt. The researcher mainly reviewed the literature available in AI and existing established but long lasting traditional systems worldwide. The writer analysed the flight delays and present military aircraft controlling procedure in a less dense air traffic region. He further interviewed and examined the present day slacks in fighter controlling in the territorial waters. The writer interviewed few professionals and scholars in concluding the research proper. Few theories were analysed critically to forecast the future of human existence with the exponential growth of human intelligence in AI.

RESULTS AND DISCUSSION

In recently concluded humanitarian operations (2009), in Sri Lanka, The SLAF was compelled to improvise its tactics in air operations. The maritime strikes and air surveillance in great seas was always a major challenged to the aircrew. Without proper facilities and equipment the SLAF has undertaken daring missions in to the deep seas. The LTTE has always utilized the sea routes in smuggling war material in to the country and they utilized the sea as an extensive platform in attacking and threatening the National Security of the country. In nullifying the latent threat of LTTE the SLAF was called to task. These kinds of missions tested the SLAF capability and professionalism in preserving the National Security. The major extension of EEZ (Exclusive Economic Zone) was always could not be protected by the Navy alone. The air power was always a necessity. This was evident by the missions carried out in intercepting LTTE ships which were smuggling weapons in to the country. The single cockpit pilots sometimes did not have the communication or radar assistance. They always depended on their elite skills and the aging machines. In a situation where you have no clue of your present position and spatial orientation a little assistance would have been a greater inspiration to the air crew in deep blue seas.

In his writing Critical Path, futurist R. Buckminster Fuller estimated that if we took all the knowledge that mankind had accumulated and transmitted until the sixteenth century, it probably took about 1500 years to double the knowledge. The next doubling of knowledge took only 250 years. By 1900, that is one hundred and fifty years later, knowledge had doubled. The speed at which information doubled is increasing, according to Fullers "Knowledge Doubling Curve", he explained that until 1900 human knowledge doubled approximately every century. By the end of World War II knowledge was doubling every 25 years. Today things are not that simple and the knowledge doubles at a faster rate than we expect. It is different by the sectors. For example, nanotechnology knowledge is doubling every two years and clinical knowledge every 18 months. The average human knowledge is doubling every 13 months. According to IBM, the build out of the "internet of things" will lead to the doubling of knowledge every 12 hours. According to Ray Kurzweil (2005) predicts that within decades humans will have the knowledge to read minds, assume different forms, and reshape his physical environment at will. When human knowledge allows us to transcend our biology, we will in effect have evolved into a new species. In a recent lecture at Harvard University neuroscientist Jeff Lichtman, who is attempting to map the human brain, has calculated that several billion petabytes of data storage would be needed to index the entire human brain. The Internet is currently estimated to be 5 million terabytes (TB) of which Google has indexed roughly 200 TB or just .004% of its total size. The numbers involved are astounding especially when considering the size of the human brain and the number of neurons in it.

18th World Computer Congress TC12 First International Conference on Artificial Intelligence applications and Innovations (Hoschi HC, Bacellos 2004), describes the intersection between Artificial Intelligence and Natural Intelligence. The presenters suggested that there is a real need of new tools to conciliate the best of AI techniques, generating methods and techniques of storage and manipulation of information. In the same research paper it describes intelligence as nothing but the capacity to learn, to apprehend or to understand, to interpret and mainly to adapt the factual situations. Kelsey (Kelsey, 2008) argues that belligerents will violate the principle of distinction more frequently in cyber warfare than in conventional warfare. Also he states that many cyber-attacks will unavoidably violate neutrality law, making these violations more likely in cyber conflicts than in conventional wars. "Autonomous weapon systems cannot be guaranteed to predictably comply with international law", Prof Sharkey mentioned tothe BBC. "Nations aren't talking to each other about this, which poses a big risk to humanity". Hence, the researcher suggests that the traditional and existing law publications and the constitution itself to be amended and modified to face new challenges in the near future. A Russian programme, Eugene was the first computer to pass the Turing test in 2014, the system managed to convince 33% of the judge panel to believe it's a 12 years old kid. In 2011 IBM's Watson won USD 1m on US TV show Jeopardy, beating two of their best ever human winners in the process. Watson was also the basis for the first ever AI Attorney, developed by students of the University of Toronto, who named it Ross. The uniqueness of Ross is that instead of relying on keyword searches, he is able to understand natural language questions along with references to support his answer, and suggest further reading material. In furtherance, Ross will learn by himself more as he is used. It is only a matter of time before we rely on robots to give legal advice but there must be

some clear efficiency to be gained by incorporating some of this technology. According to Scott Ferrauiola, associate general counsel to IBM's Watson Group, he emphasizes in handling a compliance matter, in-house lawyers or paralegals assisted by Watson could have access to a complete and up-to-date regulatory quantity that can immediately access at the point of interaction with the business 24 hours a day, seven days a week. This could help streamline and improve decision-making regarding routine labour, tax, audit or environmental matters. A recent report entitled 'Civilisation 2030, the near future for law firms' says that "It is no longer unrealistic to consider that workplace robots and their AI processing systems could reach the point of general production by 2030.Indeed, London law firm Hodge, Jones & Allen is already researching the use of AI in predicting the outcome of its cases and Berwin Leighton Paisner (BLP) is in discussions with a specialist provider of artificial intelligence to improve its ability to search documents in the field of commercial contracts. The report warns that law firms must position themselves as experts and to place a higher value on their advisory work, essentially using AI as a research assistant rather than allowing themselves to become dependent on process driven legal work, which is more likely to be delegated to AI 'bots'. "Eventually each bot would be able to do the work of a dozen low-level associates. They would not get tired. They would not seek advancement. They would not ask for pay rises. Process legal work would rapidly descend in cost".

When the world is seriously thinking of AI employment to various aspects, the enemy tomorrow will also think in the same capacity. The future enemy will utilize various techniques in breaching the national security. It is important to reconsider the future of national systems and to restructure existing systems to suit the future challenges. When the enemy is ready with the next generation technical know-how, SLAF as a military force should be far superior to face the challenges.

EXPERIMENTAL DESIGN

Scholar Barcley Ballard writing an article to the ItProPotal web site questioned the readers "Is artificial intelligence really a threat to human existence?" To identify potential dangers in AI, the researcher studied fullers' "knowledge doubling curve" and the newest technological innovations and future trends. The writer anticipates an exponential knowledge growth in near future especially, in computer science, engineering and artificial intelligence. The researcher mainly depended on various available literature and statistics in realizing the future threat. The writer interviewed few personnel who are knowledgeable in cryptography and computer security and discussed future trends of AI and potential threats to humans. The writer attempts to suggest the academia to find solutions to mitigate the effects of machine learning and criminal artefacts in future.

SLAF PERSPECTIVE

There are approximately 300-400 numbers of departures and arrivals recorded per day in the Sri Lankan Flight Information Region (FIR). Presently this air traffic is being controlled by the air traffic controllers with the help of Radar facilities. According to the delay reports at BIA (Bandaranaike International Air Port) it was evident that of due to certain human limitations many delays and incidents are inevitable. Even though the Air Traffic Controlling is being done in an air conditioned comfortable environment, the profession involves with many human limitations and risks. In case of a terrorist attack, trade union activity or in any sabotage action, human lives on air are at an enormous risk since the existing system is totally relying only on human activity. In an incapacitation of the human intervention to control the air traffic at a given moment, the air planes will be in a blind situation where the operators will be totally unaware of the surrounding air traffic. This will be a major catastrophe to an aircraft especially to a fighter jet operates far remote from the coast. The limited cognition capacity of the human brain could only handle a limited number of air traffic at a given time. Over a period of time many flights from Bandaranayake International Airport (BIA) especially the military flights have been restricted by the air traffic controllers saying it is impossible for them to handle air traffic simultaneously. In responding to this deemed necessity researcher intends to propose an autonomous air traffic controlling and management system by a cooperative multi agent negotiation which can be utilized to replace the human intervention when required. Also the system could be utilized to minimize the flight and ground delays while substituting the human cognition process especially in an emergency where the human intervention is mandatory to be replaced by the machine intelligence or Artificial Intelligence. The same idea was initially conceptualized by the veterans in expert systems in 1983 (Hayes-Roth, Waterman and Lenat, 1983) they have designed the anatomy of an ideal expert system. In RAND's models they suggest the importance of a human intervention when necessary. As a conceptual model the Centre - TRACON Automation System (CTAS) which was developed by the Air Traffic Controlling (ATC) research group of NASA (National Aeronautics and Space Administration) and FAA (Federal Aviation Authority) was considered. This system was evaluated real time in Dallas/Ft. Worth and Denver airports. According to the NASA technical memorandum 103959 (Heinz Erzberger, 1992) the system has three main tools but the functions are quite distinctive. The three main tools are Traffic Management Advisor (TMA), Descent Advisor (DA) and Final Approaching Spacing Tool (FAST).These three tools have separate predefined intelligent behaviour to assist the controller on duty. The extensive simulator evaluations of CTAS have revealed the controller acceptance of the automated air traffic assisting system and more importantly it reduced the delays and saved fuel. The empirical literature

review revealed the cost and effort involved with the system evaluation. The evaluation carried out on Final approach spacing Tool (FAST) by NASA Ames Research Centre, California and San Jose State University, California (Davis et al, 1991) exposed the real time delay reduction and increased efficiency while reducing the aircraft separation time in inter arrivals and increased the landing rate per hour. This also reduced the controllers work load and it enhanced the mental status of the controllers by reduced mental work load (Davis et al, 1991). The further analysis and research work carried out on above three tools separately revealed certain limitations and requirements such as maintenance of promised height and speed by the operator or the aircrew (Davis et al, 1989). According to the study this is also to be incorporated with the prevailing weather, winds and aircraft performances. Especially in DA tool, the algorithm was utilized by the controllers to resolve conflicts and issue appropriate advisories to the arrival traffic. This facility has ensured the fuel efficiency and conflict free descent. Finally it has the Final Approach Spacing Tool (FAST) (TJ Davis et al, 1991), which provides heading and speed clearances for an accurate spacing on the final approach. However in this particular research, the researcher fails to highlight the importance of a situation handling process such as an aircraft with an emergency. The researcher anticipates in highlighting the importance of utilizing a multi agent tool to assist the human cognition in air traffic controlling to enhance the quality and efficiency of air traffic management while minimizing the flight delays and saving fuel. Indirectly this will reserve the valuable foreign currency and most importantly will increase the international levels of airport standards at Bandaranayake International AirPort Sri Lanka. The process will also cater the increasing level of air traffic in reaching 2020 development goals. This will also reduce the work load of the air traffic controllers and increase the confidence level. Finally this will minimize the interpersonal antipathies among the human operators and enhance the safety factor and reduce accidents and incidents in Sri Lanka. This system will be utmost important in Maritime reconnaissance and maritime operations where the fighter interceptor controllers or air traffic controllers can negotiate with the AI multi agents in decision making. The delayed radar information could be corrected and promptly instruct the aviators when needed. A continuous monitoring process can be maintained throughout. Simultaneously many air craft can be handled and the information can be shared with many disciplines.

In this paper the researcher emphasizes the world trends and the future threat that any country would face if not reacted pro-actively towards knowledge growth. Sri Lanka Air Force on the other hand is in the process of amalgamating technology and 1st generation AI in to the system. However this is neither consciously done nor with dedicated intention. As the first generation AI, the SLAF employed real time data linking to the flying squadrons. The aircrew could go through the target or visualize the surroundings before they get airborne for the mission. This process markedly increased the accuracy level of air interceptions of SLAF. The long lasted war has confirmed the dire requirement of a proper maritime reconnaissance system and proved the importance of maintaining a 24 hours active surveillance system. Even at a time that Sri Lanka enjoys peace, still the requirement and the urgency prevails in another trait. However the existing reconnaissance system in SLAF will not cater the future requirement. Only available assets in SLAF at present are the Beechcraft and UAVs. However the facet of challenge has been changed and air power in surveillance positively correlates the maritime security of a country. With the exponential knowledge growth, future criminal activities and security breaches will be in a facet we will not be able to visualize easily. As a remedial action the SLAF is required to step on AI as soon as practical. This process will keep SLAF in line to face the regional threats that is yet to appear in new façades. The researcher also suggests a partially or fully automated system in data gathering and analysing. This will reduce human intervention and increase the accuracy of data gathered through airborne platforms. The same system is being utilized in more advanced manner for boarder surveillance in countries like USA. However with the available resources and with few additions, SLAF will be able to generate more productivity by amalgamating GIS (Global Information System) and AI. This will simplify the detection, identification and monitoring process by effective data gathering in maritime recce role. The system already tested in CRD with the professionals from various disciplines. The utilization of EPAS, ERMS or GERMS can be regarded as 1st level of AI that the SLAF utilizes at present. With an elaborated level of intervention by a proper R &D, it is possible to develop a proper autonomous or partially autonomous multi agent system to negotiate data gathering and analysing. This will censor the extensive utilization of pilots and observers while the available resources can be utilized in a more realistic and rational manner.

The SLAF has extensively utilized UAVs and aerial reconnaissance to analyse battle damage and aftermaths of the operations. The ground commanders were provided with a real time data link to the battle front. The decisions that he takes can be prompt as he sees his battle front live. The artillery and air attacks have been coordinated with the help of these. The same data can be utilized to automate an arty coordinating computer programme. The radars can be integrated and an autonomous system can be formulated for interception. The researcher seek the possibility to automate the collection and use of intelligence gathered from many different platforms in correlating. This will help the human being to make better use of raw sensor data from existing multiplatform, multisource and real-time data collection systems. In furtherance this can be utilized to automate intelligence information processing for assessment, cueing, electronic attack, and battle damage assessment. The 30 years prevailed war gave the Sri Lankan military a point to ponder, and it was evident that a proper joint coordinating centre as in many developed countries is paramount important to coordinate the usage of AI application. With automated data gathering and analysing not only on military sense but in non-military applications in changes on sea water level or temperature variation, can be extensively utilized for the betterment of human beings. Therefore the researcher intends to highlight the importance of a central command and research facility with the appropriate scholars in required disciplines.

RECOMMENDATION

- SLAF is recommended to develop a separate AI Command with dedicated infrastructure and resource personnel in liaise with Universities

- The researcher suggests initiating a system to consider the following facts in developing a research facility,
  - Data Base Management system and knowledgebase management
  - Modelling and case base handling
  - Workflow management and conflict resolution

- Researcher suggests to develop an autonomous multi agent system to assist the air traffic controllers cognitive ability in military aircraft controlling in Sri Lankan FIR

- Researcher suggest to develop an intelligent system with integrated GIS to monitor, identify and to notify the decision makers

- Researcher also suggest to restructure the SLAF to address the exponential knowledge growth in the future

CONLUSION

While a Hollywood movie style apocalypse may seem unrealistic, the applied nature of artificial intelligence is already around us. Mobile personal assistants IPODS, IPADS, Smart phones, and even the characters in video games are all present-day AI applications. However, while no one could reasonably suggest that AI is a threat to human existence currently, it is technology's unknown future that is concerning, particularly as artificial intelligence becomes more capable. As The Future of Life Institute warns, "Our AI systems must do what we want them to do". The writer in his research determines to forecast future threat to the SLAF with the exponential knowledge growth and to develop a framework to mitigate the potential threat by use of AI. He concludes the paper with a strong suggestion of a proper infrastructure research facility for AI integrated system. It is clear that organisations like SLAF should act now to secure the trust and expertise. If harnessed correctly, AI can assist SLAF and its certain traditional systems that have lasted for six decade in streamlining the process and taking SLAF to a better place. The future is not out there it has already arrived.

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